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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.
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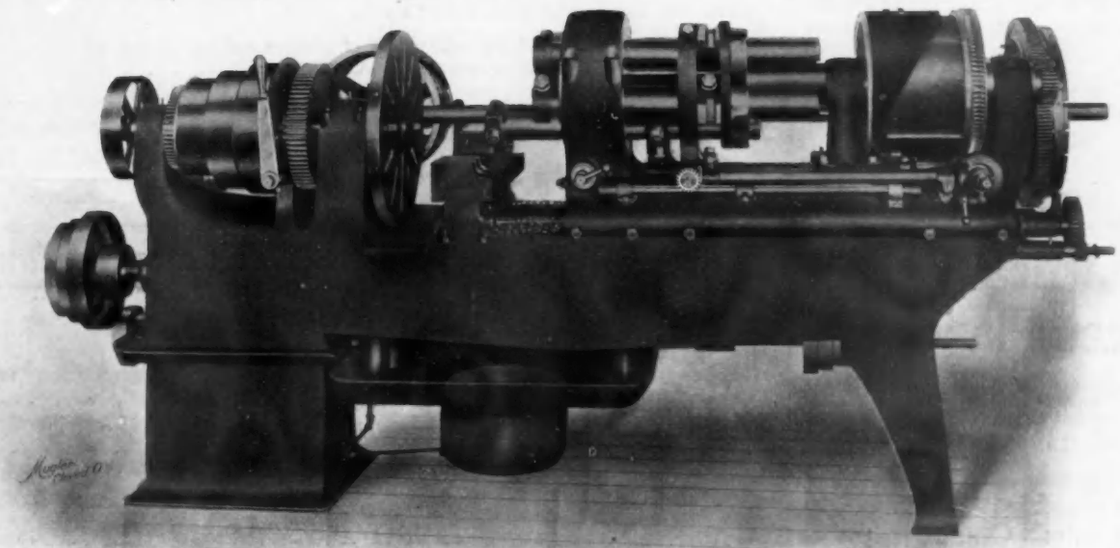
Contents and Index to Advertisers, Page 10.

A New Machine "Chuck" Full of Good Points.



"The Cleveland Automatic" Chucking Machine.

This machine is designed for automatically boring, counterboring and facing the hubs of pulleys, gears and other like parts of machinery.

The spindle cone has three steps for 3½" belt, and the clutch back gears, giving six changes of speed. The back gears are thrown in and out automatically when required for facing hubs of large diameter. Five boring and two facing tools may be used.

The machine will swing 18" and the boring tools have a movement of 8". Five changes of feed are obtained by cones, and feeding mechanism (similar to that used on our Automatic Screw Machines) providing for an independent and variable feed for each tool, and a rapid idle movement when no tool is in operation. The cross slide and tool carriage are adjustable lengthwise on the bed.

ADVANCE SHEET OF CATALOG NOW READY.

The Cleveland Machine Screw Co.,
CLEVELAND, OHIO., U. S. A.

FOREIGN HOUSES: The Cleveland Machine Screw Co., 25 Albert st., Birmingham, 61 Bd. Haussmann, Paris.
FOREIGN REPRESENTATIVES:
Chas. Churchill & Co., London and Birmingham. Schuchardt & Schutte, Berlin, Vienna, Brussels and Stockholm.

The Little Leaks

that are so small as to be hardly noticeable are important and should never be lost sight of. For instance, there's that little matter of oil that's thrown out on chips, bolts, nuts, etc.—ever think how much money you throw away every year in that way? Aside from being discolored, that oil is practically as good as it ever was, yet it's thrown away. No shop that uses as little as three barrels of oil per year, can afford to be without the means of reclaiming such oil for further use—a Roper Centrifugal Oil Separator. Let us tell you more about it.

American Tool & Machine Co.
BOSTON, MASS.

Founded 1845. Incorporated 1864. Manufacturers of **Sugar Machinery.**

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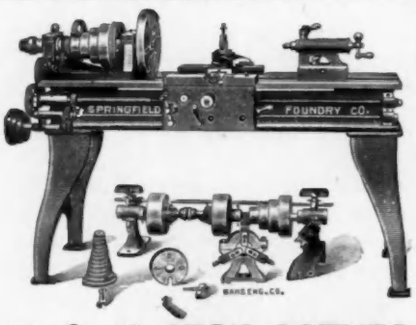
is the Planer that Whitney makes. This Planer—the P-4 Planer—is built to turn out the highest grade of wood work that it's possible to make, and to do it rapidly. One of its peculiarities is that it will plane stuff less than three inches long without clipping the ends. We don't know another planer that will do that, and we know all the good ones.

Write for the Whitney Book.

BAXTER D. WHITNEY,
WINCHENDON, MASS.



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Built by
The Springfield Foundry Co.,
Send for circular. **SPRINGFIELD, OHIO, U.S.A.**

If You Have Made Your Pile

and your only purpose in doing business is to keep some old and faithful workmen employed, you don't need this Gas Oven Furnace—the old coal furnace is good enough. But if you're doing business for the profit that's in it, you can't get this Furnace any too quick.

This particular pattern is made for annealing and hardening; is designed to heat a square or oblong space of any desired dimensions, evenly, to any degree, from a cherry red to a white heat, and to maintain any required temperature, steadily, for any desired length of time. It does just what it was designed to do.

It is used for heating cutters, dies, reamers, shears, blades, saws, etc., and for annealing all kinds of metal work. Made in twenty sizes and in the same good way that all this company's furnaces are made.

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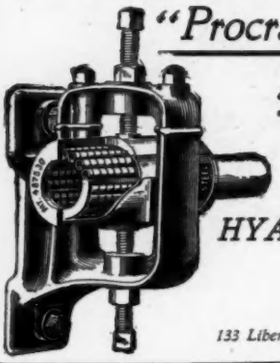
Chas. Churchill & Co., London, Birmingham and Glasgow. H. Glaenzer & Perreaud, Paris. Schuchardt & Schutte, Berlin, Cologne, Vienna.

And we make Fuel Gas Plants.

"Procrastination is the thief of time,"
and "time is money."



Every day babbitted boxes are used there is a direct loss of both time and money. . . Save much of this waste by substituting

HYATT ROLLER BEARING BOXES.

Hyatt Roller Bearing Co.,
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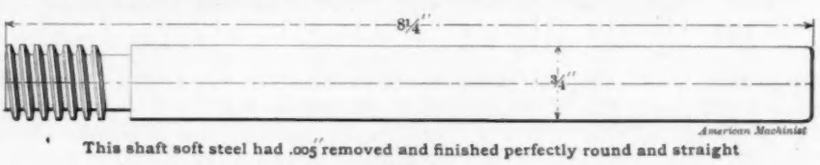
THE PEARSON MACHINE COMPANY,
Cable, "Pearson," Chicago, Lieber's Code. **37 West Randolph St., CHICAGO, ILL.**



This shaft soft steel had .005" removed and finished perfectly round and straight in 7 minutes

A Prominent Machine Tool Concern

mentions as an evidence of the careful and accurate construction of their lathes, that "the spindle is ground in order to insure its being absolutely round and straight." The inference is that this large and successful concern considers the grinder method the only way to get "absolutely" accurate results in the building of their lathes. There's a best in most everything, you know. In Grinders, it's the Landis.

Landis Tool Company,
Waynesboro, Pa., U. S. A.

Walter H. Foster, Manager, New York.
Hill, Clarke & Co., Boston and Chicago.
C. W. Burton, Griffiths & Co., London.
Ad. Janssens, Paris and Brussels.
Schuchardt & Schütte, Berlin, Cologne, Vienna and Brussels.

IMPROVED INDEPENDENT CHUCK

This cut represents a line of **IMPROVED, INDEPENDENT REVERSIBLE JAW CHUCKS** that we have lately added to our large list of Universal and Combination Chucks. We make this style of Chuck in **TWENTY-TWO SIZES**, varying in size by two inches from **FOUR** to **FORTY-TWO** inches in diameter.

SEND FOR ILLUSTRATED PRICE LIST.

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Or Chas. Churchill & Co., London and Birmingham, England. Also of Schuchardt & Schutte, Berlin, Cologne, Vienna, Stockholm and New York. Fenwick Freres, Paris, France.

"Cushman" Chucks.

We manufacture ten distinct styles of Lathe Chucks, four styles of Drill Chucks, Centering Chucks, Face Plate Jaws and Chucks for special service. Send for new catalog and discount sheet.

The Cushman Chuck Co.
Hartford, Conn., U.S.A

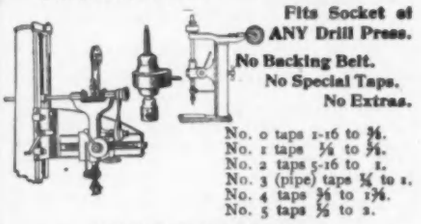
Heavy Steel CLAMP

MADE BY
Wm. G. LeCount,
Successor to C. W. LeCount,
South Norwalk, Conn.
Ask for Cat. A Machine Tools.
Agents: CHAS. CHURCHILL & Co., Ltd., London, England.

Errington AUTO-REVERSE Tapping Chuck

Drives tap in, stops automatically at bottom of hole and backs tap out (quick return) without stopping or reversing drill press spindle.

Either Friction or Positive Tool Holder.



Fits Socket of ANY Drill Press.
No Backing Belt.
No Special Taps.
No Extras.

No. 0 taps 1-16 to ¼.
No. 1 taps ⅛ to ⅜.
No. 2 taps 5-16 to 1.
No. 3 (pipe) taps ¼ to 1.
No. 4 taps ⅜ to 1¾.
No. 5 taps ½ to 2.

Skinner Chucks.

Independent and Universal Chucks, Combination Lathe Chucks with patent reversible jaws, Drill Chucks, Planer Chucks, and Face Plate Jaws.

Skinner Chuck Co.,
New Britain, Conn.
Send for Catalog.
94 Reade Street, New York.

Automatic Machines for making Wood Screws

Asa S. Cook Co.,
Hartford, Conn., U. S. A.

The More You Know

about other chucks, the more you'll want the "Reid." Send for our book.

R. H. BROWN & CO.,
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The Sweetland is the Best

Combination, Simple, Accurate.
Independent, Solid Shell, Solid Reversible Jaw.
Geared Scroll, with Solid Reversible Jaw.

Hoggson & Pettis Mfg. Co.
New Haven, Conn., U.S.A.

ERRINGTON AUTO-REVERSE Drill Press Turret

Tools changed and friction adjusted while spindle is rotating without danger to operator.

Drills the hole, taps it and then sets the stud in, all without stopping or reversing drill press and without moving work.

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England—Chas. Churchill & Co., London and Birmingham. **Germany, Austria, Sweden and Belgium**—Schuchardt & Schütte, Berlin, Cologne, Vienna, Stockholm, and Brussels; **France**, Adiphe. Janssens and Fenwick, Freres & Cie., Paris; **Italy**, Adler & Eisenschitz, Milan.

ALL A DRILL CHUCK IS GOOD FOR

is to hold drills so they can't slip. The drill chuck that wont do it belongs on the scrap heap, and the quicker it gets there the better.

The one chuck that will hold drills from slipping, anytime and all the time, is the Pratt Positive Drive Drill Chuck, the chuck with the equalizing driver.

This equalizing driver floats on top of the jaws and holds the flattened end of the drill shank. All the jaws are expected to do is to hold the drill from falling out, and center it.

Full details in our Free Booklet.

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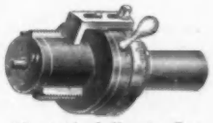
Scroll Saws

Trump Bros. Machine Co., Mfrs.,
Wilmington, Del., U. S. A.

For sale by Charles Churchill & Co., Ltd., London, Eng.

It Costs Something To Back Out.



Adjustable Collapsing Tap, Flat Chaser Style.

Every time you back out a die it costs money; — not a lot of money, to be sure, but enough to make a big difference in the cost of your tapping operations by the year.

There's no backing out when you use our Adjustable Collapsing Taps—the chasers collapse after your thread is tapped and the tap comes straight up and out without a bit of bother.

These time-saving taps are made in a good many good sizes and styles, for use on screw machine turrets or for rotating, and for tapping any kind of metal, either for pipe or straight threads of 1¼ inches, or larger, diameter.

They'll cut your tapping costs 50% if you're using solid dies.

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FOR SALE BY
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H. Glaenzer & Perreaud, Paris, France.
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Split or Wire Chucks

of every description. Special Taps and Dies, all pitches and sizes, with fine threads.
All sorts of small backed off Forming Cutters, Plain Cutters, Reamers, Saws, etc.
Small Turret work in quantities.
Small articles in quantities to order.
Best workmanship guaranteed.
Send for latest complete catalog.

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Bound Volume

For 1898 Now.

Price, $4.00.

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NEW LONDON, CONN.

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Index to Advertisers.

	PAGE
Acme Machinery Co	16
Adams Co., The	8
Albro-Clem Elevator Co	11
Alexander Mfg. Co., J. G	6
Almond, T. R	49
Alteneder & Son, Theo	54
American Gas Furnace Co	2
American Machinery Co	51
American Tool & Machine Co	2
American Tool Works Co	45
Armstrong Bros. Tool Co	7
Arthur Co., The	49
Atlas Mfg. Co	15
Backus Water Motor Co	49
Baird & Co., Henry Carey	6
Baird Machinery Co., U	44
Baker Brothers	55
Baldwin, Davidson & Wight	41
Ball Bearing Co	16
Barnes & Co., W. F. & John	4
Bay State Iron Works	12
Beaman & Smith	44
Becker Mfg. Co., John	51
Bement, Miles & Co	14
Berlin Iron Bridge Co	44
Besly & Co., Chas. H	56
Bethlehem Foundry & Machine Co	54
Bethlehem Steel Co	55
Bickford Drill & Tool Co	3
Bignall & Keeler Mfg. Co	7
Bilgram, Hugo	43
Blaisdell & Co., P	6
Bliss Co., E. W	6
Boston Gear Works	49
Bradford Mill Co., The	53
Bristol Co	56
Brown Hoisting & Conveying Mach. Co	46
Brown & Sharpe Mfg. Co	56
Brown & Co., R. H	9
Buffalo Forge Co	56
Bullard Machine Tool Co	5
Bullock Electric Mfg. Co	47
Burt Mfg. Co	41
Caldwell Co., W. E	54
Carborundum Co., The	43
Card Mfg. Co., S. W	52
C & C Electric Co	50
Chambersburg Engineering Co	54
Cincinnati Mach. Tool Co	7
Cincinnati Milling Machine Co	51
Cincinnati Planer Co	15
Cincinnati Radial Drill Co	55
Cincinnati Shaper Co	16
Clark, Jr., & Co., Jas. R	42
Cleveland Ball & Screw Co	6
Cleveland Gear Works	42
Cleveland Machine Screw Co	1
Cleveland Stone Co	8
Cleveland Twist Drill Co	56
Colcord Machinery Co., W. R	12
Columbus Machine Co	54
Cook Co., Asa S	9
Crescent Steel Co	7
Crosby Steam Gage & Valve Co	7
Cumberland Iron & Steel Shafting Co	7
Curtis & Co., Mfg. Co	49
Curtis & Curtis	7
Cushman Chuck Co	9
Lallett & Co., Thomas H	55
D'Amour & Littledale Mach. Co	3
Davis Machine Co., W. F	16
Dayton Globe Iron Works Co	54
Detrick & Harvey Machine Co	11
Detroit Lubricator Co	54
Diamond Mach. Co	4
Dietz, Schumacher & Boye	46
Dixon Crucible Co., Joseph	14
Doan & Co., J. B	12
Draper Machine Tool Co	50
Dreses, Mueller & Co	46
Eames Co., G. T	52
Eastern Machinery Co	52
Eddy Electric Mfg. Co	52
Errington, F. A	9
Evans Friction Cone Co	8
Falkenau, A	14
Faneuil Watch Tool Co	56
Fellows Gear Shaper Co	52
Fifield Tool Co	56
Flather & Co	16
Foos Gas Engine Co	54
Foote, Burt & Co	3
Frick Co	54
Garvin Machine Co., The	44
General Electric Co., The	55
Geometric Drill Co	9
Gisholt Machine Co	3
Gleason Tool Co	56
Goodell-Pratt Co	5
Goodyear, S. W	4
Gould & Eberhardt	16
Grant Gear Works	16
Grant Machine Tool Works	6
Gray Co., G. A	16
Hadley, George A	13
Hamilton Machine Tool Co	55
Hammacher, Schlemmer & Co	43
Hampden Corundum Wheel Co	15
Hardinge Bros	9
Harrington, Son & Co., Edwin	50
Hartford Steam Boiler Insp. & Ins. Co	54
Heald & Son, L. S	46
Henderer's Sons, A. L	46
Hendey Mach. Co	11
Hill, Clarke & Co	13
Hilles & Jones Co	3
Hoggson & Pettis Mfg. Co	9
Hoppes Mfg. Co	3
Horsburgh & Scott	56
Horton & Son Co., E	9
Hunt Co., C. W	14
Hurlbut-Rogers Machine Co	13
Hyatt Roller Bearing Co	2
Ingersoll-Sergeant Drill Co	49
International Correspondence Schools	52
Jenkins Brothers	43
Jones & Lamson Machine Co	16
Kempsmith Machine Tool Co	4
Keuffel & Esser Co	52
Landis Tool Co	2
Le Blond Machine Tool Co., R. K	56
Le Count, Wm. G	9
Leffel & Co., James	54
Lodge & Shipley Machine Tool Co	46
Long, John D	42
Long & Allstatter Co	45
Lucas & Gliem	16
McCabe, J. J	12 and 13
Marshall & Huschart Machinery Co	12
Mergenthaler & Co., Ott	47
Michigan College of Mines	54
Mietz & Weiss	54
Mitts & Merrill	52
Morse Twist Drill & Mach. Co	15
Morse, Williams & Co	11
Morton Mfg. Co	44
Mossberg & Granville Mfg. Co	42
National Machine & Tool Co	8
Newark Machine Tool Works	16
New Era Iron Works	54
New Haven Mfg. Co	8
New Process Twist Drill Co	8
Newton Machine Tool Works, Inc	11
Niagara Machine & Tool Works	55
Nicholson File Co	43
Nicholson & Co., W. H	55
Niles Tool Works Co., New York	12
Niles Tool Works Co. (Hamilton)	51
Norton Electrical Instrument Co	12
Norton Emery Wheel Co	49
Oesterlein Machine Co., The	16
Pearson Machine Co	2
Pencoyd Iron Works	12
Pond Machine Tool Co	45
Pond Machine Co., L. W	7
Poole & Son Co., Robt	15
Potter & Johnston Co	6
Pratt Institute	52
Pratt & Whitney Co	53
Pratt Chuck Co	9
Prentice Bros. Co	5
Prentiss Tool & Supply Co	12
Purdue University	43
Putnam Machine Works	16
Q & C Co	14
Quint, A. D	3
Rahn & Mayer	55
Reed Co., F. E	49
Reeves Pulley Co	8
Rogers Boat, Gage & Drill Works, John	15
Rudolphi & Krummel	3
Rue Mfg. Co	54
Sackmann, F. A	7
Safety Emery Wheel Co	8
Saunders' Sons, D	8
Sawyer Tool Co	3
Sebastian Lathe Co	52
Sellers & Co., Inc., William	16
Seneca Falls Mfg. Co	4
Shultz Belting Co	16
Sibley & Ware	49
Sittman & Pitt	46
Skinner Chuck Co	9
Slocomb & Co., J. T	14
Smith & Mills	4
Speirs & Co., J. C	54
Spencer Auto. Mach. Screw Co	15
Springfield Foundry Co	2
Springfield Gas Engine Co	54
Springfield Machine Tool Co	53
Standard Pneumatic Tool Co	4
Standard Tool Co	15
Starrett Co., L. S	14
Steel Ball Co	7
Stevens Arms & Tool Co., J	7
St. Louis Machine Tool Co	49
Stover Novelty Works	4
Stuart's Foundry & Machine Works, R. J	56
Tabor Mfg. Co	54
Tight Joint Co	55
Toomey, Frank	12
Trump Brothers' Machine Co	9
Turner, Vaughn & Taylor Co	8
Union Tire Co	44
Vanderbeek Tool Works	42
Warner & Swasey	56
Watson-Stillman Co., The	44
Weber Gas & Gasoline Engine Co	54
Webster Mfg. Co	54
Webster & Perks Tool Co	52
Wells Bros. & Co	56
Whitcomb Mfg. Co	14
Whitney, Baxter D	2
Whitney Mfg. Co	50
Whiton Machine Co., D. E	9
Wiley & Russell Mfg. Co	3
Wiley & Sons, John	43
Williams & Co., J. H	42
Windsor Machine Co	8
Winkley, F. D	16
Wood's Sons, T. B	11
Woodward & Powell Planer Co	43
Woodward & Rogers	41
Worcester Machine Screw Co	11
Wyman & Gordon	56
York Co., S. M	13
Young Mfg. Co., W. C	4

Contents.

	PAGE
The Increase in the Use of Machinery	17
Commercial Review	18
Machine Tools to be Installed in the New Building at New York Navy Yard	20
Electric Switchboards and Their Use. By Wm. Baxter, Jr	21
New Vehicles at the Electrical Exhibition—II. By Hugh Dolnar	23
New Stop-Gage for Screw-Cutting Lathes	25
Press Fits	27
American Compressed Air Tools in Great Britain	27
Band-Sawing a Bevel Pinion. By W. H. Freeman	28
A New Friction Clutch	29
Die Construction. By Geo. B. Painter	29
Workmen's Indemnity in France	31
An Expensive Autographic Torsion Testing Apparatus. By Robert A. Bruce	31
Some Constants for Use in Designing Elliptic Springs. By F. F. Gaines.	33
Letters from Practical Men: From the Other Hemisphere. By W. H. Freeman....High-School Foundry Instruction. By L. C. Jewett....Marking the Edges of Draftsmen's Curves. By Eugene Motchman....An Experimental Shop. By Florin....Workmen's Savings. By Wm. Newton....A Foreman's Time Notes. By H. S. Brown....One Way to Pay Off. By Alfred Speer....Fixing up a Planer. By Planer	35-39
Shop Literature	39
Questions and Answers	39
The Growing Use of Steam and Other Motive Power in Germany	40
Technical Publications	40
Personal	40
Obituary	40

AMERICAN MACHINIST

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The Increase in the Use of Machinery.

Our editorial on the future of the English market for American machine tools, published last week, showing the absolute lack of sufficient machinists to do the work offering in England, opens up room for agreeable thought on the part of all mechanical men. The usual explanation of the great press of work in English shops is that it is simply the arrears of work resulting from the great strike of 1897-8, but we confess we are beginning to get a little tired of that explanation. No American manager, we think, would have the hardihood to plead a strike of eighteen months ago as the cause of delay in filling orders now. It appears to us rather that the vast expansion in the use of machinery is making itself felt in the manner described.

It has, in fact, been a constant surprise to us that it has not been so felt before. When the enormous increase in the use of machinery during the past twenty years is considered, the question where the machinists to make it have come from is a constant enigma. The entire electrical industry is the creation of that period of time. Had anyone twenty years ago predicted the present vast development of that industry he would have been asked where the men to do the work were to be found, and he could not have answered the question. This industry, it is to be noted, has created its own field. In most of its applications it has supplanted nothing. Even in lighting, by familiarizing people with better artificial light, it has actually increased the use of gas. In the field of the trolley car it has interfered seriously with horse breeding, but even here, mechanically considered, it has called for a new body of men.

The subject is much broader than it at first appears, for every industry, and the electrical industry especially, supports many others. The electrical development has supplied an enormous market for steam engines and boilers, as well as adding appreciably to the consumption of iron and steel, and very markedly to the consumption of copper and some other materials. Such added consumption has lent its quota to the market for mining and metallurgical machinery, while the management and up-keep of all this equipment have furnished employment for a great quantity of skilled labor. Other, though less important, new industries have had a similar effect, while the tremendous increase in the consumption of iron and steel in building and other operations has tended in the same way.

In the immediate future is another industry, which, like the electric industry, will create a new demand for skilled machinists—the automobile industry. There can be no doubt that this it to attain large dimensions and that its effects on the labor market will be far reaching.

To the question How has this work been done and how is it to be done? there can be but one answer—through labor-saving machinery. But for such machinery the work of to-day could not be done, and still less can that of the future be done. Were it attempted, the effort would defeat itself through the increased cost of the articles produced. Through the use of such machinery the bicycle, for example, has been brought to its present price. It is clear enough that were the manufacture of bicycles conducted by hand processes and by the skilled labor that such processes involve, the cost would be so enhanced as to put it beyond the reach of nearly all who now enjoy it. In the same way there can be no doubt that the present immense consumption of all mechanical products is largely due to the cheapness of production by labor-saving machinery.

Meanwhile this same labor-saving machinery must be made, and in its production by general consent our own country is pre-eminent. Developed originally to meet our own needs, it has now found a new and unexpected market abroad. At home its production has employed large numbers of men, and now still more employment is being supplied in equipping foreign shops. In the foreign field, American automatic machine tools, like electrical machinery in the home field, have created a market of their own and supplied employment to thousands, while at the same time putting our country in the forefront of producing nations. Surely if anyone has reason to think kindly of labor-saving machine tools it is the American mechanic.

This is the age of machinery, and the future is to be still more so. Of all trades, that of the machinist, and of all machinists, the American is most secure. As we have said before of the machinist, all streams of improvement bring grist to his mill, and just now most of the streams lead to the United States.

It is perhaps a little unfortunate that certain terms relating to business are so often used interchangeably when they really mean entirely different things. For instance, the recent sale of the water works bonds of the city of Cincinnati at a premium which makes the net return upon these bonds 2.83 per cent. shows that this figure is about the average return which capital can secure on investments that are considered entirely safe. Where capital receives a higher rate of interest than this it is certain that a greater risk of loss is involved, and where the returns on capital invested in business are considerably greater then the increase over the figure named is almost certainly compensation for able management or beyond this a return on a monopoly of some form. There should be a little clearer distinction between capital considered by itself and monopoly. Transactions in bonds are constantly showing that the returns on capital by itself considered are small and are growing smaller every day, but where capital is used in business the returns must, of course, and should be greater, and where it is used in connection with monopoly the returns may be anything that the monopoly will afford.

Mr. and Mrs. John D. Davis, who started from New York on the 13th inst. in an automobile to make a trip to San Francisco, encountered, the first day out, a number of adventures with their machine, including the breakage of a cylinder, and they found it necessary to add a third passenger in the person of a machinist, who accompanied them a part of the distance to keep things in working order. Until automobiles become more common than they are now it seems pretty certain that some such experiences will be quite frequent with those who undertake extensive trips with them.

No student of shop-management problems should fail to read the pen-picture drawn under the title of "An Experimental Shop," published elsewhere in this issue. It is a vivid representation of how such things are managed by those who give no real thought to them, and especially those who fail to appreciate the great fact that a successful work-shop manager must recognize the factor of human nature and must work in harmony with it.

It is stated that the proposed combination among bicycle manufacturers has finally been abandoned, the announcement of the Western Wheel Works, Gormully & Jeffery, and the Indiana Bicycle Company that they were out of it having made the scheme impracticable. It seems to be generally believed that the craze for combinations has passed its culmination, and that such schemes are on the wane, in New York at least.

Commercial Review.

NEW YORK, SATURDAY EVENING,
July 15, 1899.

MACHINERY NEWS OF INTEREST.

This is supposably the time for "midsummer dullness," but rarely, if ever, has there been a week more replete with important news items in the machinery line than has been the one just closing.

The Executive Committee of the Manhattan Elevated Railway Company met, Tuesday, July 11, and awarded to the Edward P. Allis Company, of Milwaukee, the contract for eight engines for the power house that will be built in order to operate the road by electric traction. These engines are of 8,000 rated horsepower each, making 64,000 in the aggregate; but they will be capable of developing up to 100,000 horse-power. It is reported that seven engine builders competed, that the bid of the Allis Company was the lowest, and that the amount of the contract approximates $1,000,000.

The Edward P. Allis Company has also lately closed a contract to furnish three 1,000 horse-power engines for the James River Construction Company, Richmond, Va., to be used as auxiliary to the water-power-distribution system which is being installed there. A novel feature of the plant is that the engines are intended for use when the river is at too high, rather than too low, a stage for the water-wheels; thus reversing the ordinary practice in such cases.

The E. P. Allis Company has also sold two 800 horse-power engines to the Virginia Electric Company, Norfolk, Va., and two of 200 horse-power each for the New Amsterdam Gas Company, New York City.

A plant for the manufacture of electrical apparatus, and more or less closely identified with the Westinghouse interests in this country, is to be built near Manchester, England. This much has received satisfactory confirmation. Reports in connection with the matter are, that 100 acres of land have been acquired for the purpose, that the works will cover forty acres, that they will have a capacity for employing 5,000 hands, that the enterprise is backed by $7,500,000 of British capital, and that Lord Kelvin will act as electrical adviser for the company. At the new plant is to be manufactured a general line of electrical machinery and supplies for the foreign market of the Westinghouse Company; but we infer that they intend still to manufacture some of the largest machines for European sale in this country, as is the case with the General Electric Company in relation to its foreign affiliated companies.

A Pittsburgh dispatch is to the effect that George Westinghouse, Jr., has just cabled from Europe notice of a contract from the Russian Imperial Railway to equip all of its cars for the next four years with Westinghouse automatic air brakes. These are to be made at Russian works, under Westinghouse control.

The Westinghouse interests are said to have on hand a contract for four 1,800-kilowatt dynamos and engines for the Bloom street generating station, Manchester, England. These will be used for lighting purposes. They will be built in East Pittsburgh.

The control of the Stanley Electric Manufacturing Company, Pittsfield, Mass., has been acquired by New York parties. The price paid was $150 per share. It is understood that the purchasers are parties interested in the Sprague Electric Company. While it appears from authoritative statements that a merger has not yet taken place, officials carefully avoid denial that something of the sort is contemplated. Mr. Henry Hine, manager of the Stanley Company, has become also general manager of the Sprague Company.

The Electric Vehicle Company has placed orders for 4,200 electric vehicles, amounting in value to over $8,000,000. The Columbia & Electric Vehicle Company, said to be controlled by the Electric Vehicle Company, will execute a large share of the work.

The automobile industry is cropping up in a way that suggests the bicycle boom a few years ago. In fact bicycle plants that have outlived their profitableness in that direction are being turned to automobile manufacture. Two currently reported instances of this nature are as follows: The Elgin (Ill.) Sewing Machine & Bicycle Works have just been purchased for the manufacture of automobiles. The C. H. Sieg Manufacturing Company, Kenosha, Wis., is to be reorganized and turned to making automobiles and gasoline engines. This company is said to have done a successful bicycle business in the five years during which it has been in its present plant.

The General Electric Company is said to be experimenting with automobiles.

The National Tube Company, a new combine with $80,000,000 capital and 25,000 men on its pay rolls, has been formally organized.

The New York manager of a Western boiler company stated yesterday that if he had fifty boilers ready for immediate delivery he could sell them all at 10 or 15 per cent. above present prices. He says that the demand is not letting up one particle; that the steel plate situation seems to be getting a trifle easier, because of additional plants that have been started up, but that the amount now being made is none too great for requirements. He predicts that prices of steel will not be seen lower than at present until they have gone still higher.

For the Imperial Crown Prince's palace, which is being built in Tokio, Japan, a fan system heating and ventilating apparatus has been ordered of the Buffalo Forge Company. The fan is of special design and has an engine of the United States Government type, direct attached, for driving it. Each section of the heater is valved separately. The arrangement is such that either live or exhaust steam may be used entirely, or any portion of live or exhaust steam that is desired. The design of the Buffalo heater is such as to afford the greatest possible convenience in this respect, which feature is stated to have won the order at a price one-third higher than that of any other submitted.

The Buffalo Forge Company has in course of construction another large order from the Japanese Government, comprising pressure blowers for foundry work, etc.

MACHINERY EXPORTS FOR MAY.

The Monthly Summary of Commerce and Finance, prepared by the Bureau of Statistics, Treasury Department, for May, 1899, shows exports of metal-working machinery during that month amounting to $471,445. For May, 1898, the value was $461,758. That for April, 1899, has already been reported at $578,151. The total for eleven months ending May, 1899, is $5,882,165, and for the eleven months ending May, 1898, $4,164,931.

Electrical machinery exports were: May, 1899, $241,103; May, 1898, $180,494; April, 1899, $195,955; eleven months ending May, 1899, $2,517,797; eleven months ending May, 1898, $1,883,306.

Printing presses and parts thereof: May, 1899, $75,313; May, 1898, $55,073; April, 1899, $107,617; eleven months ending May, 1899, $772,181; eleven months ending May, 1898, $818,018.

Pumps and pumping machinery: May, 1899, $255,547; May, 1898, $167,302; April, 1899, $255,229; eleven months ending May, 1899, $2,484,783; eleven months ending May, 1898, $1,835,036.

Locomotive engines: May, 1899, 31 in number, at $211,128, total value; May, 1898, 53, at $446,583; April, 1899, 42, at $365,545; eleven months ending May, 1899, 445, at $4,009,347; eleven months ending May, 1898, 419, at $3,429,665.

Stationary engines: May, 1899, 103 in number, at $29,612, total value; May, 1898, 47, at $21,559; April, 1899, 59, at $42,666; eleven months ending May, 1899, 519, at $286,709; eleven months ending May, 1898, 522, at $377,017.

Boilers and parts of engines: May, 1899, $88,341; May, 1898, $153,641; April, 1899, $95,574; eleven months ending May, 1899, $1,049,412; eleven months ending May, 1898, $880,111.

Typewriting machines and parts thereof: May, 1899, $247,787; May, 1898, $191,483; April, 1899, $281,674; eleven months ending May, 1899, $2,213,540; eleven months ending May, 1898, $1,738,703.

Sewing machines and parts thereof: May, 1899, $327,477; May, 1898, $347,509; April, 1899, $339,354; eleven months ending May, 1899, $2,949,164; eleven months ending May, 1898, $2,816,429.

Shoe machinery: May, 1899, $65,571; May, 1898, $110,662; April, 1899, $47,614; eleven months ending May, 1899, $777,277; eleven months ending May, 1898, $832,936.

CHICAGO MACHINERY MARKET.

Midsummer dulness is experiencing great difficulties in asserting itself this year in the machinists' supply trade. In some lines there is a falling away of orders, due to the closing of works for repairs, inventory, etc., but in the way of power transmission the usual signs of July are entirely absent. Shafting in store here is scarce. Dealers find it impossible to preserve their stocks. They are continually running out of one size or another. Belting manufacturers have all the work they can do. Rope drives are being put into place almost without number. Pulleys cannot be turned out fast enough to supply the demand. One large manufacturer of pulleys here has contracts with three other foundries for supplying him with the product which his own plant is unable to make. W. A. Jones, of the W. A. Jones Foundry & Machine Company, was asked the nature of this unusual trade in power transmission. He said: "About 5 per cent. of it is repair work, possibly 10 per cent., but I think 5 per cent. is nearer right. The remaining 95 per cent. is about equally divided between old plants, which are extending their facilities, and the equipment of entirely new plants. Almost every kind of manufacturing plant, so situated that it can enlarge its capacity, is building an extension."

Various kinds of supplies for metal manufactories are enjoying the same overflowing trade. Thus, in electro-plating supplies the trade of the Hanson & Van Winkle Company, confined chiefly to manufactories that do their own plating and not to jobbing platers, was for June 150 per cent. better than for any previous month in the history of the company in the West. July so far is showing up about as well as June. It is chiefly a mail-order trade, coming without solicitation. Charles H. Besly & Co. say their trade is not falling off at all. They have seasonable goods at this time of year, and with them business is supposed to be good at all times, but the activity of summer is more pronounced than ever. Brass goods of all kinds are moving freely. Seamless tubing is an excellent seller. Repair work is active, and considerable buying for fall work is noticeable.

Machinists' supplies are suffering to some extent from the season. The bicycle works are subsiding. There is more or less suspension of operations at agricultural implement and other factories. But aggregate trade denotes that with all this subsidence there remains an unusual degree of activity. Of iron and steel material a marked scarcity continues, though there are some evidences of accumulation at consuming plants. Generally speaking, trade in machinists' supplies runs very largely to heavy contracts. Users have in many instances provided for their needs through the coming winter. One large emery wheel house now has enough orders booked to keep its plant busy for nine months if no additional orders are received. Ordinarily heretofore a three months' advance booking has been deemed in every way satisfactory. Values of supplies are slightly appreciating, but not so rapidly as a month ago.

July trade of the Chicago Pneumatic Tool Company promises to exceed that of June, which broke the company's previous monthly record. Over five hundred orders for pneumatic tools were then booked. Many tools were shipped to Europe; a large order was filled for parties in the South African Republic, and another shipment was made to Australia. The factory of the National Pneumatic Tool Company, of Philadelphia, the control of which was recently acquired by the Chicago Pneumatic Tool Company, is running to its fullest capacity, day and night, as is also the St. Louis factory of the latter.

CINCINNATI REPORT.

In this part of the Central West continued activity prevails among all those who manufacture machinery, and reports of further expansion are still heard here and there. The trouble in getting materials is one which affects manufacture of iron and steel products pretty extensively. People who were not fortunate enough to secure a large stock before the rise in prices have now to pay an advance which amounts to almost anything. Here, as elsewhere, it is hard to get orders for pig iron filled promptly, and some consumers have lately been offering a bonus of 25 cents a ton for quick shipment. A new feature of trade is that whereas in ordinary times consumers do not generally begin earlier than September to send in orders for pig iron for shipment in the next year, quite a number of orders have been taken for delivery in the first half of 1900 at present prices. Foundrymen are sharing in the growth of business and with increased cost of raw materials are receiving better prices for their products. One of the oldest foundry establishments remarks a difficulty in securing good workmen, although wages are now high. Brass goods and electrical machinery and supplies come in for their respective shares of the activity here prevailing, as reports from those lines bear evidence. It would appear that increased prices are preventing the closing up of municipal contracts involving the extensive use of iron and steel products. This is evident from the report of a steam pump manufacturer located here, that the business now coming in is chiefly in general lines, since contracts for large water works plants, for which plans have been drawn up, are delayed by the fact that in order to meet the increased cost of material for the plant bonds would have to be issued to a larger amount than was anticipated.

The Lodge & Shipley Machine Tool Company reports prosperous business, in common with others. Being now in their new plant, can meet their large home and export demand in a satisfactory manner.

The Cincinnati Milling Machine Company is making good progress with the addition to its plant, which, it is said, when completed, will be one of the finest of the kind here or elsewhere, and will add greatly to the company's facilities for meeting the expansion in its trade.

The J. A. Fay & Egan Company has added a 60-inch planer to its plant. The company has an order from Scotland for a sander, 80 inches wide, which will be used for sanding cork in the manufacture of cork carpets.

One of the machine tool manufacturers here reports a 45-per-cent. increase in trade for the first half of this year, as compared with the first half of last.

Quotations.

NEW YORK, Monday, July 17.

Iron — American pig, tidewater delivery:—

Pennsylvania irons:

No. 1 X foundry	$20 00 @ 20 75
No. 2 foundry	19 50 @ 19 75
No. 2 plain	18 50 @ 19 10

Alabama irons:

No. 1 foundry	19 25 @ 20 50
No. 2 foundry	18 75 @ 19 25
No. 3 foundry	18 25 @ 18 50
No. 1 soft	19 25 @ 20 25
No. 2 soft	18 75 @ 19 25
Foundry forge	17 25 @ 18 00

Bar Iron—Base sizes—Refined, from store, 2.30 @ 2.35c.; common, from store, 2.20 @ 2.25c.

Tool Steel — Base sizes — Standard quality, 7½ @ 8½c.; extra grades, 12 @ 14c.; special grades, 16c., and upward.

Machinery Steel—Base sizes—Ordinary brands, from store, in small lots, 2½c.

Cold Rolled Steel Shafting—Base sizes—From store, in small lots, 3½c.

Copper—Carload lots, Lake Superior ingot, 18½c.; electrolytic, 17⅜c. @ 17½c.; casting copper, 17¼ @ 17⅜c.

Pig Lead—Carload lots, 4.60c., f. o. b., New York.

Pig Tin—In 5 and 10 ton lots, f. o. b., 29⅜c.

Spelter—Prime Western in carload lots, 6¼ @ 6½c., spot; futures, 5.90 @ 6⅛c., New York delivery.

Antimony—In cask lots and over, Cookson's, 11c.; Hallett's 9.80 @ 9.85c.

Machine Tools to be Installed in the New Building at New York Navy Yard.

The following is a complete list of all the tools that are to be installed in the new engineering shop to be erected at the New York Navy Yard. It is here made public for the first time:

One planing machine, to plane 120 inches wide by 96 inches high by 22 feet long.

One planing machine, 60x60 inches by 8 feet.

One planing machine, 48x48 inches by 14 feet.

One planing machine, 42x42 inches by 12 feet.

One planing machine, 36x36 inches by 8 feet.

One planing machine, 36x36 inches by 12 feet.

One planing machine, 36x36 inches by 20 feet.

One planing machine, 30x30 inches by 8 feet.

One planing machine, 16x16 inches by 4 feet.

One horizontal boring, drilling and milling machine, spindle to be 8 inches diameter, bed at least 20 feet high by 5 feet wide by 20 feet deep.

One portable milling, boring and drilling machine, boring bar 4 inches diameter.

One horizontal boring, drilling and milling machine, spindle to be 6½ inches diameter, bed 12 feet square.

One horizontal boring and milling machine, table 8 feet long, boring bar 4½ inches diameter.

One horizontal boring and drilling machine, table 10 feet long, boring bar 6 inches diameter.

One universal horizontal drilling and boring machine, spindle 4½ inches, table to be 48x60 inches.

One universal horizontal drilling and boring machine, 3-inch spindle, table 48x36 inches.

One 30-inch boring and turning mill.

One 37-inch vertical boring and turning mill.

Two 42-inch boring and turning mills.

One 51-inch boring and turning mill.

One 62-inch vertical boring and turning mill.

One 76-inch boring and turning mill.

One extra heavy 10-16-foot boring mill.

One 9-foot universal radial drill.

Two 72-inch universal radial drills.

Two 72-inch semi-universal radial drills.

Six 72-inch radial drills.

Three 37-inch back-geared power-feed drill presses.

Eight 30-inch back-geared power-feed vertical drill presses.

Eight 21-inch vertical drills.

Six 16-inch sensitive drills.

Six 13-inch sensitive drills.

One universal milling machine, table feed 33 inches, cross feed 8 inches, vertical movement of knee 21 inches.

One universal milling machine, table longitudinal feed 28 inches, transverse movement 8 inches; table to have working surface of 48x9¾ inches.

One No. 2 universal milling machine, table feed 30½ inches, cross feed about 6½ inches.

One No. 1 universal milling machine, longitudinal feed 17 inches, transverse movement 6 inches.

One vertical milling machine, 3½-inch spindle, vertical traverse of 17 inches, compound table 26x28 inches.

One plain milling machine, longitudinal feed of 48 inches, transverse movement of 9¾ inches, vertical movement of 18 inches.

One No. 2 plain milling machine, automatic longitudinal feed of 28 inches, transverse movement 6½ inches; vertical movement 18 inches.

One No. 1 plain milling machine, longitudinal feed of 24 inches, transverse movement 6½ inches, vertical adjustment of 18 inches.

One No. 0 plain milling machine, longitudinal feed 16 inches, transverse movement 4¼ inches, vertical adjustment 14½ inches.

One nut milling machine, for finishing the sides of nuts, 4-inch feed.

One screw-slotting machine, hand lever to have movement of 3 inches.

One extra heavy 125-inch crank shaft and engine lathe.

One extra heavy 60-inch engine lathe.

One 54-inch swing triple-geared engine lathe.

One 48-inch swing triple-geared engine lathe.

One 42-inch swing triple-geared engine lathe.

Three 36-inch swing triple-geared engine lathes.

Four 32-inch swing triple-geared engine lathes.

Four 30-inch screw-cutting engine lathes.

Four 28-inch screw-cutting engine lathes.

Four 24-inch screw-cutting engine lathes.

Six 20-inch back-geared screw-cutting engine lathes.

Six 18-inch back-geared screw-cutting engine lathes.

Six 16-inch swing back-geared engine lathes.

Four 12-inch swing back-geared engine lathes.

One 14-inch tool-room lathe.

Two 20-inch swing brass lathes.

Two 18-inch swing brass lathes.

Two 16-inch swing back-geared brass lathes.

Two screw machines, from ⅛ to 1½ inches diameter.

One strapping lathe, to weigh 600 pounds.

One 2x24 flat turret lathe.

Two triple-geared turret lathes, to swing 26 inches over the ways and 16½ inches over the carriage; bed to be 10 feet long.

Two turret machines to swing 22 inches over the ways and 13½ inches over the carriage; bed to be 8 feet 3 inches long.

Two 15-inch post shapers.

Two 22-inch post shapers.

Two double 16-inch shapers.

Two double 18-inch shapers.

Two 24-inch shaping machines.

One 30-inch draw-cut shaper.

One portable shaper, 48x48x72 inches.

One 48-inch portable key-seating and slotting machine.

One 20-inch slotter.

One 10-inch slotting machine.

One special double-end grinding machine, to weigh not less than 1,300 pounds.

One universal cutter and reamer grinder, to take 18 inches between centers.

One five-wheel floor grinder.

One tool grinder.

One bolt-pointing machine, ¼ to 1 inch.

One bolt-pointing machine, ½ to 2 inches.

One grinder for lathe centers.

Four twist-drill grinders, ½ to 2 inches.

One combined cutting-off lathe and nut and bolt head facing machine.

One rotary nut-tapping machine.

One bulldozer press.

One set hydraulic jacks, from 4 to 30 tons.

Electric Switchboards and Their Use

BY WM. BAXTER, JR.

The switchboard, in the strictest sense of the word, is not an indispensable adjunct of an electrical installation, and in fact was unknown for several years after the introduction of electric lighting. It first came into use, in a very crude form, as a matter of convenience; it was gradually elaborated, and at the present time is regarded as a part of the system only second in importance to the generator itself. It belongs to that vast class of apparatus that first come into use as a luxury and finally come to be regarded as a necessity. At the present time we would consider it impossible to operate a boiler without a steam gage, but they were so used in days gone by, and if we had no gage we could get along without it. These remarks are equally applicable to the electrical switchboard.

In the early days of "arc" lighting the wires from the binding posts of the dynamo were run directly out to the lamp circuit, in most cases not even a switch being used. Whenever it became necessary to discontinue the lights the dynamo was stopped. Before long it became evident that a switch introduced into the circuit would be a convenience, as then it would be possible to put out the lights without stopping the dynamo, and this certainly would be advantageous in cases where it was desired to suspend the lights for only a few minutes. In this way the switch for opening the line came into use. Very early in the history of "arc" lighting it was discovered that unless the current remained practically uniform, the lamps would not burn steadily; hence it became desirable to have an instrument whereby the current strength could be indicated, and this brought into use the ammeter. With incandescent lighting it was soon found that uniformity of pressure was the point of vital importance, and thus the voltmeter was introduced in such installations. In "arc" lighting the current remains of constant strength, therefore there is no danger of burning out the generator by overloading. In the incandescent lighting system the case is different; each lamp adds its quota to the current strength required, and if the number of lamps is sufficiently increased, the current will become strong enough to burn out the generator, providing there is enough power behind it to keep it running. To prevent burning out generators of the incandescent type, by overloading, safety devices were gotten up; these acting by opening the circuit and thus stopping the flow of current whenever the danger limit is reached. There are two types of safety devices used to avoid the destructive effects of overloads; one is the "safety fuse," which is simply a piece of wire of such size that it will be melted by a current of sufficient strength to injure the generator, and the other is the "circuit breaker," which is actuated by a magnet, the strength of which is exerted in opposition to a spring or some other counteracting force. The strength of the magnet increases with the current, and when the predetermined point is reached the device acts, as at that point the force of the magnet is sufficient to overcome the reactive force. Generators used for incandescent lighting are designed to develop the required pressure at a certain velocity of rotation, but it frequently happens that for one reason or another it is not practicable to obtain just this speed. In order that the generator may be able to develop the desired voltage, even if the velocity is somewhat varied, a device is provided by means of which the pressure may be increased or decreased without changing the velocity. This device is simply a resistance, or rheostat, and is called a field regulator. If the voltage of the generator is too high, a sufficient portion of the regulator resistance is thrown into the circuit of the generator field coils to bring it down to the required point, and if the voltage is too low the regulator resistance is cut out.

From the foregoing it can be seen that to successfully operate a single constant potential generator all we require is a field regulator, a circuit breaker, an ammeter, a voltmeter and a switch to open the circuit. To this we should also add switches for opening independently the several branch circuits. From Fig. 1 an idea of the devices and the manner in which they are connected can be obtained. In this diagram *A* represents the generator armature, and *M* is the shunt field coil. The coil in heavy lines directly above *M* is the series field, and its office is to keep the voltage constant as the current strength increases and decreases. The field regulator is shown at *R*, the ammeter at *A m* and the voltmeter at *V*. The main switch is shown at *S*, the circuit breaker at *f*, and the branch circuit switches at *d d d*. It will be evident at once that it is immaterial in what part of the engine or generator room these various devices are located so long as they are where they can be seen and readily reached when desired. As to the switches *d d d*, it is not necessary that they should even be in the same room as the generator, for they can be placed at the points where the several circuits branch off. It can be readily realized, however, that if they are located in some systematic order at some convenient point they will not only present a more methodical appearance, but will

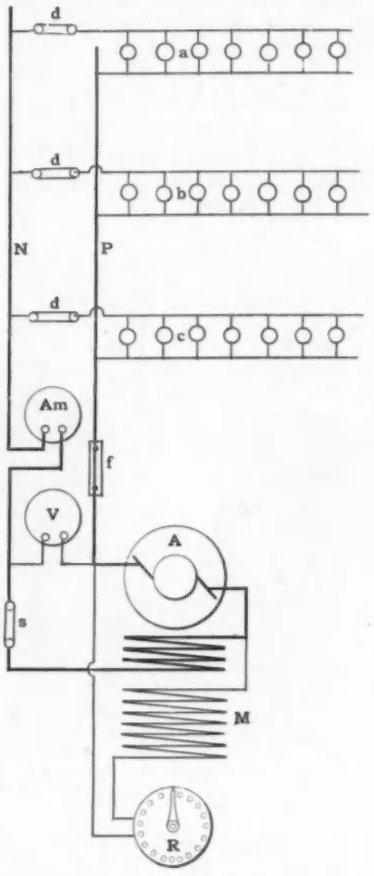


Fig. 1

SCHEME FOR CONNECTING UP A SINGLE CONSTANT POTENTIAL GENERATOR.

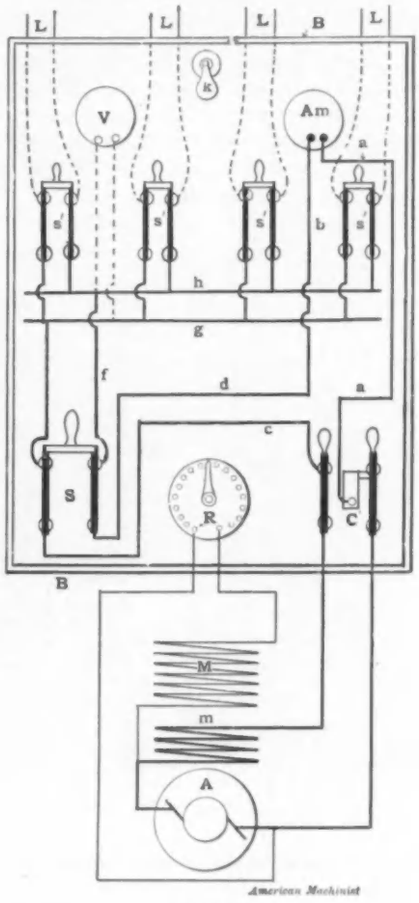


Fig. 2

SYSTEMATIC ARRANGEMENT OF FIG. 1 ON A SWITCHBOARD.

actually become a greater convenience. A switchboard is nothing more nor less than a board upon which these several devices are arranged in systematic order. For the case shown in Fig. 1 the switchboard would assume the appearance shown in Fig. 2. Here we see that the field regulator is located at the bottom of the board between the main switch *S* and the circuit breaker *C*. Before the days of switchboards the field regulator was generally located on the floor by the side of the generator, and the voltmeter, ammeter and other devices were strewn along the wall wherever there was an available space. In the regularly organized board of Fig. 2 the voltmeter and ammeter are located at the top. By tracing the lines that indicate the circuit wires it will be seen that the line runs from the right side brush of the generator to the circuit breaker, and from the central contact of this to the ammeter,

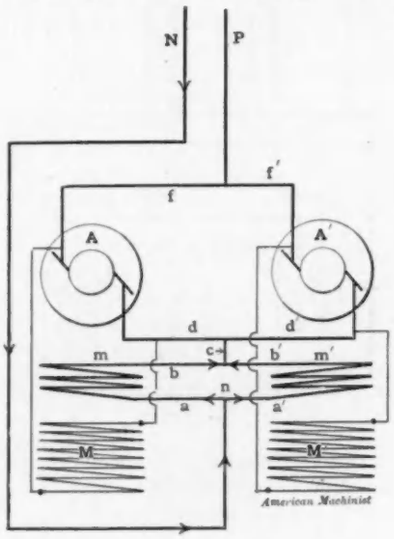


Fig. 3

THE EQUALIZING CONNECTION OF TWO GENERATORS CONNECTED IN PARALLEL.

by wire *a*, and thence, by wire *b*, to wire *d* to the bottom of the main switch *S*, from which it passes by *f* to wire *h*. The wires *h* and *g* are called bus bars, as they form a common terminus from which the several circuits controlled by the small switches *s' s'* are derived. If the branch circuits *L L L* are very numerous the board *B* can be made wider, if there is room in the place where it is located to increase its dimensions in that direction. If such is not the case, its hight can be increased, and the *s'* switches can be placed in two or three rows one above the other. A light placed at *k* serves to illuminate the board so that the attendant may be able to see the position of the switches and take readings of the instruments at all times.

In Fig. 1 it will be noticed that the ammeter is placed so that all the current of the generator passes through it, but the voltmeter is in a circuit of its own, between the wires *N* and *P*. The ammeter is an instrument of very low resistance, and as it measures the strength of the current, all the current must pass through it; but the voltmeter measures the pressure; hence, it must be acted upon by the total pressure, and to be so acted upon it must bridge the circuit from one side to the other, that is, from wire *N* to wire *P*. The amount of current that passes through the voltmeter is very small, owing to the fact that it is wound with fine wire and its resistance is very high. In Fig. 2 the voltmeter wires connect with the buses *g* and *h*, but these, as will be found by tracing the wires, are the two sides of the circuit, just as the wires *N* and *P* in Fig. 1.

When it is desired to operate two or

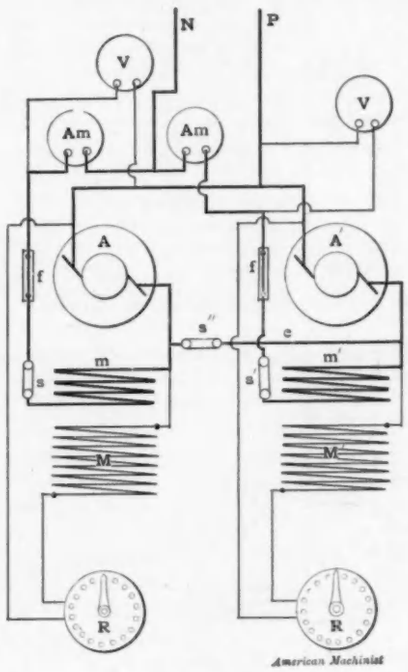


Fig. 4

SCHEME FOR CONNECTING UP TWO GENERATORS IN PARALLEL.

more generators in parallel, that is, so as to feed into the same system of external wires, the simplicity of Figs. 1 and 2 cannot be preserved, for then it becomes necessary to provide means that will prevent one of the generators from taking more than its share of the load. If the machines are of the simple shunt-wound type, that is, if they are not provided with the series coils *m*, shown in Fig. 2, nothing can be done to equalize the work between them, except to adjust the field regulators so that all the generators develop the same voltage, and if they are all of the same size and design, so that the variation in pressure will be the same, practically, in all as the current strength changes. No one machine will be likely to take a portion of the load differing from its proper proportion by more than a few per cent. Shunt-wound generators, however, are seldom used owing to the fact that they cannot maintain as uniform a voltage as the compound type; that is, those having the series coils *m*. When two or more generators of this latter type are connected in parallel it is necessary to so connect the series coils that the strength of current passing through them will be the same in all the machines. This result is attained by the type of connection shown in Fig. 3. By examining this diagram it will be seen that the lower ends of the two series coils are connected with each other, and that this is also the case with the upper ends. As *m* and *m'* are of the same resistance in generators of the same size, or nearly so, the current coming through wire *N* will divide upon reaching *n*, one half passing to *m*, by wire *a*, and the other half to *m'*, by wire *a'*. Through wires *b* and *b'* the current will reach the short wire *c*, and from here it may, and it may not, pass in equal amounts by the wires *d* and *d'* to the two armatures. If the wires *b b' d d'* and *c* were not provided, and the current from armature *A* passed directly to coil *m*, and that from armature *A'* to coil *m'*, then the current flowing in these coils would be of the same strength as that in the respective armatures. Under these conditions any tendency for the generators to run unequally would be aggravated, for the armature developing the strongest current would be acted upon by the strongest *m* coil, and the effect of this would be to still further increase its current in consequence of the increase in voltage due to the increased strength of the field. When the wires *d d' b b'* and *c* are added, which are called the equalizing connection, the current generated by the two machines is equally divided between the two series coils *m* and *m'*, and the result is that the difference in the strength of the currents generated in the two armatures cannot be very great.

For the operation of two generators in parallel the instruments and apparatus required and the connection of the circuits must be as indicated in Fig. 4. This diagram shows the various parts without any reference to systematic arrangement. We have, as in the case of the single generator, a field regulator for each machine, and also an ammeter and a voltmeter; these being shown at *Am* and at *V*. At *f* and *f'* are shown the circuit breakers, and at *s* a switch for opening the circuit of the left-side generator, while at *s'* is a similar switch for the right-side generator. In this diagram the wire *e* is the equalizing wire and takes the place of the wires *d d'*, *b b'* and *c*, in Fig. 3.

If we were to open switch *s*, the left-side generator would not be entirely disconnected from the other one, for through wire *e* the current of armature *A'* could pass to and through armature *A*, and thus to line wire *P*; thus short-circuiting armature *A'* through armature *A*. To be able to entirely disconnect the two generators it is necessary, therefore, to provide the additional switch *s''*. When the gener-

ators are running, it is not safe to open the switch s'' in the equalizing wire before the s switch is opened, and when it is desired to cut the second machines into the circuit, it is not safe to close the s'' switch first. To avoid accidents by the improper manipulation of these switches, it is necessary to provide switches that combine s and s'' in one, so that by the movement of a single handle both circuits are opened. Such switches are called two-pole switches. Even with this arrangement we would not be able to entirely disconnect either one of the generators from the circuit; for, as will be noticed, if the switches s and s'' are opened, the armature A will still be connected with the line wire P; hence, if A were grounded, both generators would become useless. For a complete separation of the two machines we must have another switch in the wire running from line wire P to armature A.

All these various switches, field regulators and measuring instruments could be distributed around the engine room, wherever thought to be the most convenient; but it is evident that their proper manipulation could be greatly facilitated by resorting to an elaboration of the systematic arrangement of parts illustrated in Fig. 2. The same simplicity could not be maintained, as there would be more switches, circuit breakers and instruments to locate, and the circuit connection would be more complicated; but as all the parts would be bunched together, the two generators could be controlled with the same ease as the single machine.

Fast mail train No. 8 on the Chicago, Burlington & Quincy Railroad left Mendota, Ill., on June 28, forty minutes late, and ran to Riverside, a distance of 72 miles, in 62 minutes, or at the rate of 69.67 miles an hour. The train was hauled by one of the Burlington's class "P" locomotives, No. 1,591, with Engineer Dove at the throttle.

New Vehicles at the Electrical Exhibition—II.

The Columbia Automobile Company, successors to Pope Manufacturing Company Motor Carriage Department, made the largest, most varied and most elegant display of the five exhibits at the Electric Exhibition, and each one of the nine Columbia vehicles shown displayed points of great interest to the student of mechanical vehicle construction. All of the Columbia work is evidently made without regard to cost, the one aim being manifestly to produce work of the highest class and most luxurious description in the way of private carriages perfectly adapted to meet the requirements of wealth and fashion.

Figs. 4 and 5 show two of the Columbia phaetons of about the same over-all dimensions and general style and purpose, but differing materially in form of body and in spring work. One of these phaetons has four plain elliptic springs, two over each axle, and a small upright dash-board, while the other has a single "reversed elliptic" spring in front, and a very large and high curved dash-board. The under frame of both of these phaetons is substantially the same, the widely separated reach tubes being jointed to the front axle so as to give entire freedom of vertical axle movement. The dash-board is quite as needful in a mechanical vehicle as in a horse-drawn wagon, since it ensures a certain degree of privacy and seclusion for the lower members and drapery of passengers, and aids in the retention of lap robes in proper position, and is a great protection against the wind, which is very surprisingly in evidence in rapid riding, and demands the shield afforded by the dash-board to make the passengers comfortable, even in very warm weather. The frames of these two wagons, constructed entirely of steel tube, are very simple in form, and the spring work is such as to give great ease of movement to the body.

Fig. 6, the Columbia Stanhope, has a much more highly organized frame, the reach members being carried forward at a high level and connected to a double cross-bar in front, curved downward, and the front axle taking the form of a bow-string girder, jointed at its middle and highest point to the lowest point of the curved double front cross-bar of the frame before mentioned, thus obtaining a construction quite similar in movement to that of the Waverly running gear, as described in a previous article in these columns. The front spring is a single half-elliptic, linked to the two high reach members, two full elliptics being placed over the rear axle. This Stanhope is a very elegant carriage in every particular of finish, fine enough to travel in any company.

The Columbia showed a magnificent brougham, and several fine examples of dogcarts, of which illustrations cannot be given for want of space.

The Columbia delivery wagon is shown, front quarter view, in Fig. 7. The front axle is a straight, solid forging, and the front spring is a reversed elliptic. The wheels are of wood, with solid rubber tires. The rear spring work is shown in Fig. 8, and consists of the usual linked arrangement of four half-elliptics, with the novel addition of a substantial four-leaved spring member, linked to hang below the front member of the rear spring work proper. The use of this supplemental spring member is to give a spring support to the heavy motor which drives this wagon; the front end of the motor frame being carried on the clip, which takes hold of the motor spring at its middle. The spring work of this delivery wagon is very fine and substantial; as it has need to be, to carry the great weight of the wagon and batteries and motor, which must always be out of all reasonable pro-

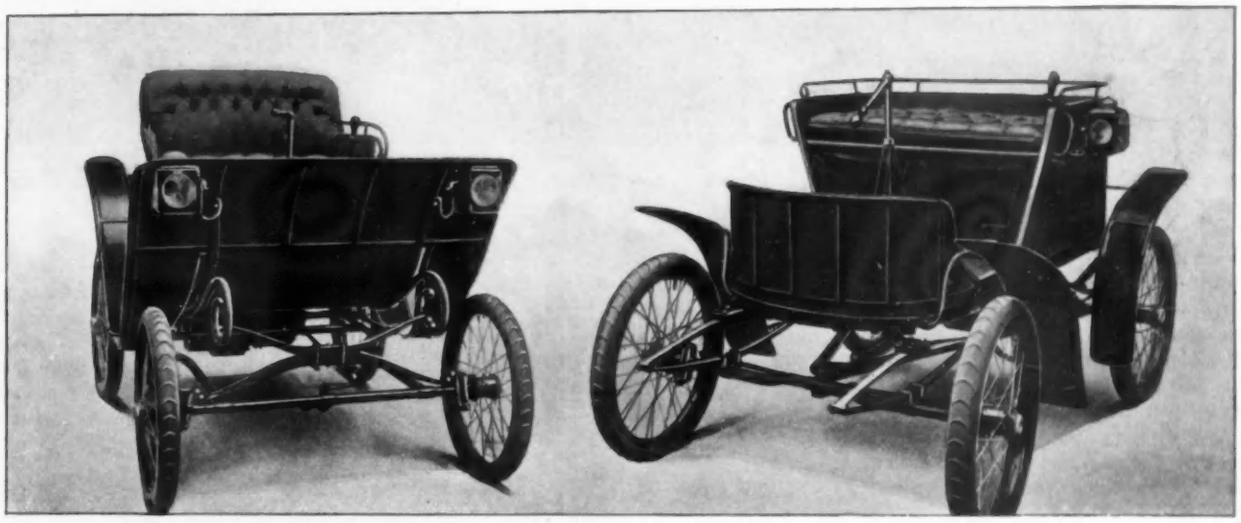


FIG. 5. COLUMBIA PHAETON, REVERSED ELLIPTIC FRONT SPRING.

FIG. 4. COLUMBIA LIGHT PHAETON.

portion to the weight of the paying load in a storage battery driven vehicle. For all that, the electric parcels delivery wagon seems to be the best thing yet offered for the use of the large department stores; and when it is remembered that vehicles drawn by two horses weighing nine or ten hundred pounds each, have in the animals themselves a ton of non-paying load and motive power, subject to harness and horse-shoeing charges, and liable to sickness and death, it is easy to see that the storage battery delivery wagon is on more than even terms with horse service, because the non-paying load of the mechanical wagon does not exceed that of horse traction, does not have to be fed when not working, and is less liable to extinction of value by disintegration of battery elements than the horse is by the natural contingencies and limitations of animal life. The great cost of horse traction arises from the fact that the horse or any other animal constantly carries on a variety of expensive operations of animal economy, which must be paid for by the owner whether the animal is in work or idle. In the case of the mechanical motor, all motive power expenses stop when the wagon stops; while with animal traction the motive power expenses are continuous, and never stop until the animal dies, when replacement at large cost becomes needful.

Fig. 9 shows one of two "Emergency" wagons built by the Columbia company for the Consolidated Traction Company, of Pittsburgh, which operates the trolley lines of that city. This is a very large, heavy and powerful vehicle, and has built into the front end of the body a strong hinged and erectible extension ladder. These two wagons carry stretchers to receive the wounded in case of accident to the person, and all supplies needed for effecting line and track repairs, and answer the purposes of the wrecking train in steam railway service. But in street trolley service the track is at once obstructed in case of accident, so that the trolley "Emergency" wagon cannot reach the place where it is needed over the train line, but must travel in the roadway. It is highly important that the trolley emergency wagon should reach the scene of disaster as quickly as possible, and should be provided with appliances to meet all requirements of line repair and first aid to the injured. Hence the built-in extension ladder, the stretchers and the full supply of materials for all ordinary line repairs, all carried by a strong and

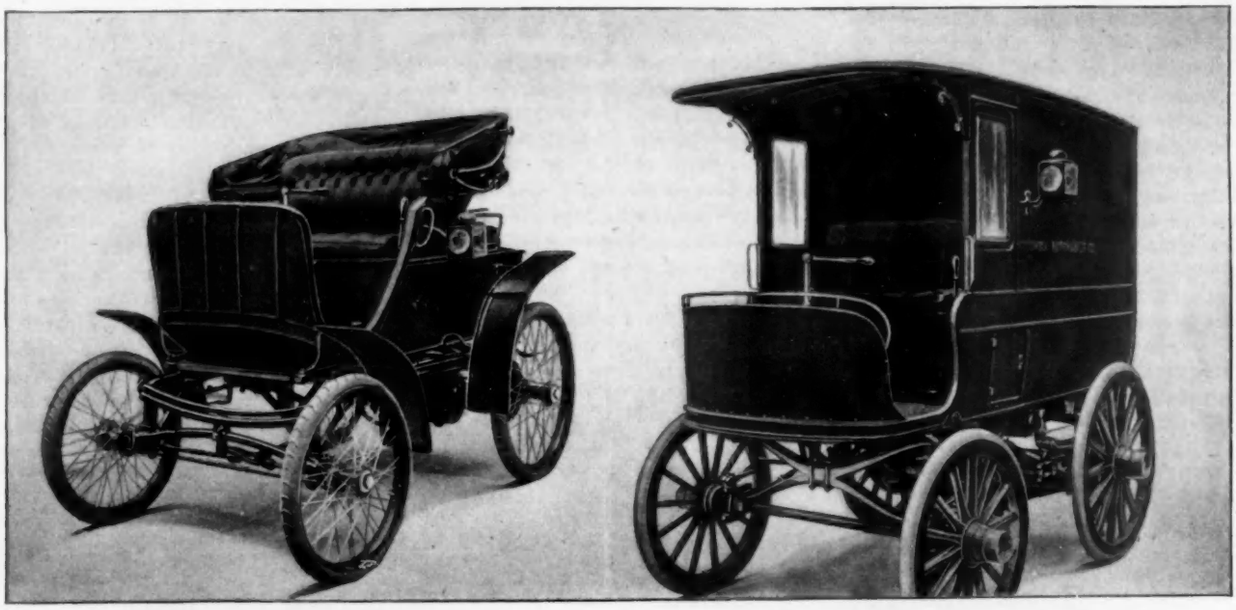


FIG. 6. COLUMBIA STANHOPE BOW-STRING TRUSSED AXLE.

FIG. 7. COLUMBIA DELIVERY WAGON. REVERSED ELLIPTIC SPRING IN FRONT AXLE.

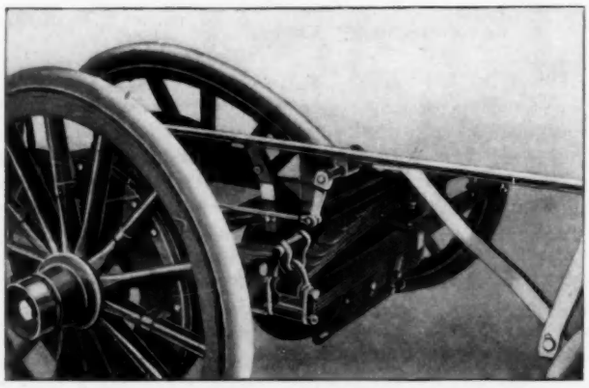


FIG. 8. COLUMBIA DELIVERY WAGON. VIEW OF MOTOR CARRYING SPRINGS.

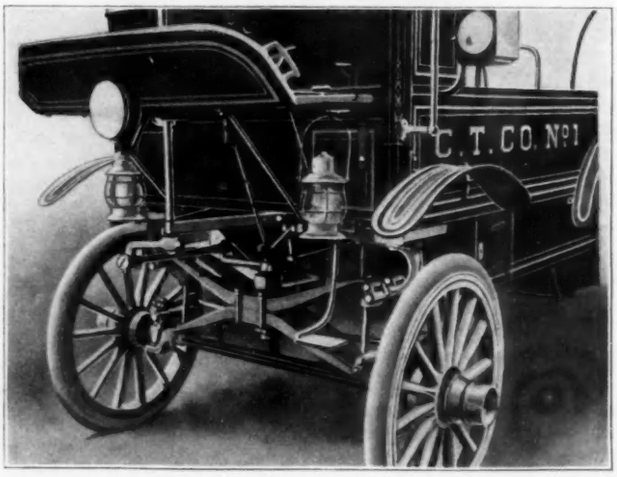


FIG. 9. FRONT SPRINGS AND STEERING MECHANISM OF "EMERGENCY WAGON."

powerfully driven wagon of the form shown, which has seats at the sides, omnibus fashion, for the wrecking crew, which is constantly on duty at the central station. These are the first mechanical trolley repair wagons made, and their performance will be noted with interest. It appears to be quite the correct thing to give this electric motocycle form to a trolley line emergency wagon, and the Columbia design seems to very completely meet the requirements of this rather exacting problem. This emergency wagon is the heaviest electric automobile, I think, which has ever been produced anywhere. The wheels are of wood, with very heavy solid rubber tires, and the running gear is extremely substantial. Fig. 10 shows the front axle work. The axle itself is a solid forging, and the springs take the form of a double reversed elliptic with link suspension of excellent design. Fig. 10 also shows the details of the steering gear, and is worthy of close study as an example of the forward running gear work for heavy mechanical vehicles. The heavy automobile, the vehicle which is to carry loads

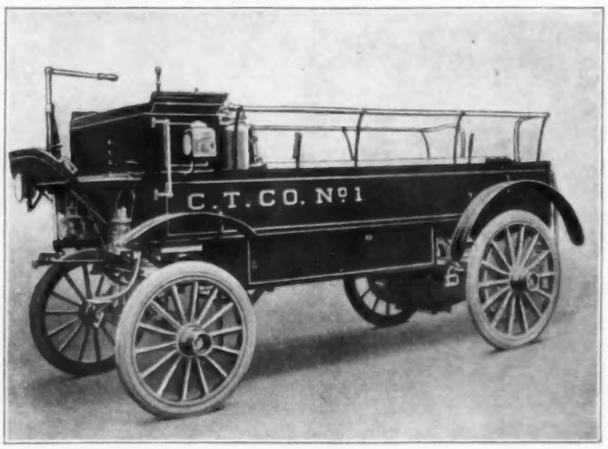


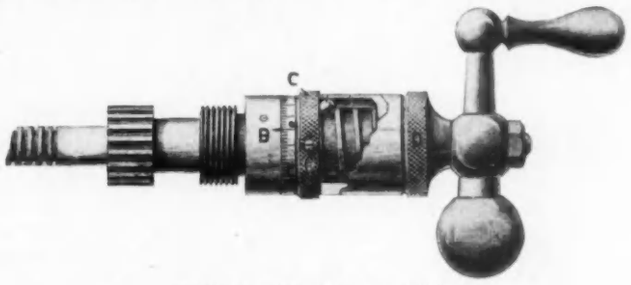
FIG. 10. TRACTION COMPANY'S "EMERGENCY WAGON." COLUMBIA COMPANY.

and take the place of the express wagon, the truck and the furniture van, has not yet been shown in anything approaching usable form. These examples of electric wagon running gear show what is needed, or at least what is now thought by the best constructors to be needed, to carry loads up to about 4,000 pounds total wheel load, and hence go a long way towards the load of the truck and furniture van. Express wagon weights are fully met in the present practice. A New York truck must carry about 3 tons of paying load, I think, and the most important problem of the automobile for city use, and the most difficult as well, is this city truck. So far nothing has been shown in the way of wheels except the ordinary wooden wheel and steel tire which gives any promise of suitability for truck use, and the wooden wheel and steel tire and Belgian block pavement, taken together, form a noise-producing combination which is not desirable; first, because noise is very unpleasant and wearing to the nerves, and, second, because noise in any class of machinery, except, possibly, ore stamps, drop-hammers and pile-drivers, indicates faulty design, needless cost in operation, and repairs which might be avoided if the designer understood his business. To say nothing of the great first cost of solid rubber tires to carry a ton load on each, practice gives no hope that such tires would have a life of any length. Solid rubber bears a certain load and impact with great fortitude, but when this moderate load is exceeded the rubber crushes, and when a solid rubber tire has one short section of its circumference crushed by dropping under a heavy load from one paving stone to another lower one, the whole tire is speedily destroyed, as a lamination commences at the point of crushing. The English traction engine makers have done a vast amount of experimenting with rubber tires of great weight and cost, plain and armored, the armor being in many instances highly ingenious and seemingly well adapted to protect the enormously heavy rubber tires used, with the final result of abandoning the use of rubber altogether, I think. With steel tires a quiet city is impossible, and a clean, noiseless city is at this moment one of the most urgent demands of human advancement. Smooth pavements may, however, prove to be the solution of the problem, and without horses we shall need no other kind.

HUGH DOLNAR.

New Stop-Gage for Screw-Cutting Lathes.

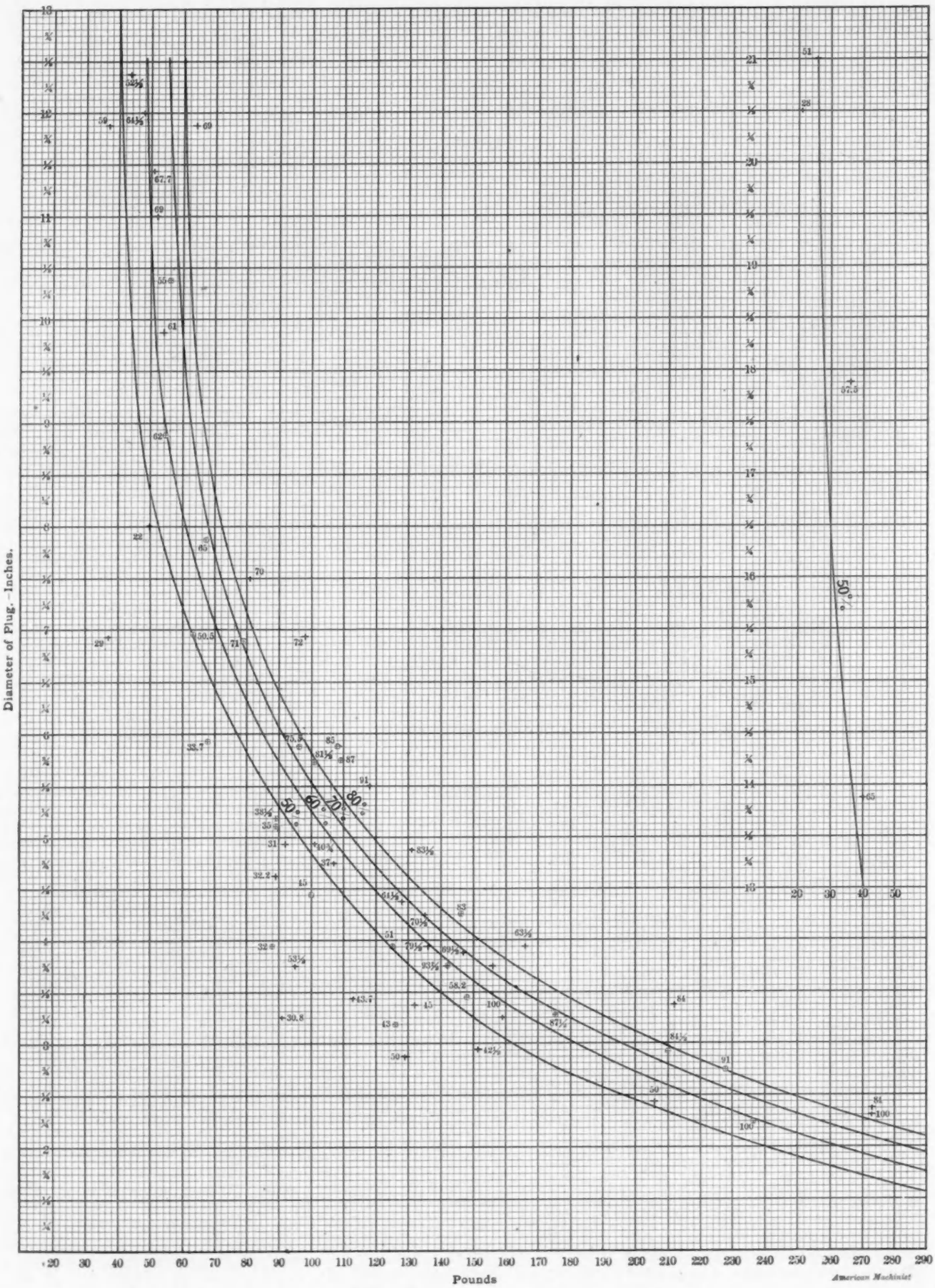
The Barker & Chard Machine Tool Company, of Cincinnati, Ohio, send us a photograph of the 18-inch engine lathe they are building, and although this is a substantial and good-looking tool, possessing such modern features as the slab-sided foot-stock, five-stepped cone, slipping clutch for driving the feed-rod by gears, etc., its unique feature consists in the stop attached to the cross-feed screw and used in setting cuts when screw-cutting. We show a partial section of the device. The equivalent of the regular threaded thimble which is screwed into the front of the saddle and forms the bearing for the screw, is seen at *B*, and to this is fitted the knurled and graduated collar *C*, which is a free working fit upon *B*, but may be tightened upon it to create any desired degree of frictional resistance to turning. An extension of *C* to the right has a spiral groove or thread formed upon it in which a steel ball is placed, and that portion of the ball which projects above the groove is engaged by a lengthwise groove formed in the interior of the sleeve *D*, which is keyed to the cross-feed screw.



STOP-GAGE FOR SCREW CUTTING.

In operation the tool is first brought into position for taking the first cut, and the sleeve *C*, being loose, is then rotated to the left until the ball is carried along to the position shown, in which no further rotation of *C* can take place without also rotating *D* and the cross-feed screw. The binding screw in *C* is then tightened to give the desired frictional resistance, and at the end of the cut the tool is run back, as usual, to clear the work, and when this is done the groove in *D* carries the ball with it around *C* and away from the shoulder with which it is shown in contact. On again running the tool up to position for cutting, the ball is brought back to the position shown, and when this has been done further rotation of the screw can take place only by carrying the sleeve *C* with it, and the amount of the sleeve's rotation, as indicated by the graduations, shows the depth of cut to be taken by the tool.

For an inside thread no change of any kind is required, and the only difference is that in setting the device at the beginning the collar *C* is rotated in the



FORCE FIT DIAGRAM.

opposite direction so as to bring the ball to the opposite end of its run. Thus a gage for the cuts is provided which shows the operator just how deep his cuts are, is always in place ready for use, is equally applicable to external or internal threading, and is used also for the ordinary purposes of micrometer graduations on the cross-feed screw.

Press Fits.

For several years the Lane & Bodley Company, of Cincinnati, have been keeping a record of observations on press fits with a view to making an analysis of them when a sufficient body of data had accumulated, and thus obtain a guide for future practice. Over eight hundred cases of such press fits have now been recorded, forming a body of data which is probably unequalled. These data have been plotted, compared and analyzed by Mr. T. C. Kelly, who has had charge of the record, and his conclusions are embodied in the accompanying diagram.

In these records the measurements have been made with great thoroughness. Both plug and hole have been measured on two diameters and at both ends—the average of these micrometer readings being taken as the true diameter. The pressures have been read at the beginning, middle and end of the length of the fit; the material of both plug and ring, the length of the fit, the radial thickness of the hub, the areas and volumes of the fitted surfaces, and some other minor points have been noted—twenty-four entries being regularly made for each case. The resulting diagram will thus be seen to have a very broad foundation, and it forms, we believe, the only rule or guide for this work based on experiment which has been published.

In ordinary cases the quantities which are fixed by the conditions are the nominal diameter and length of the fit, the radial thickness of the hub, and the material. With these given it is required to find the press allowance for a given pressure to force the plug home. Regarding the influence of these various factors, Mr. Kelly's conclusions are that the pressure varies:

I. Directly as the surface of the fit for a given diameter.

II. Directly as the press fit allowance—this allowance being such as not to stretch the metal beyond the elastic limit.

III. As some function of the radial thickness of the hub, which, while not determined mathematically, is shown in the diagram.

IV. With the materials used in a manner not yet determined owing to insufficient data. The diagram is for steel or iron shafts and cast-iron cranks. Cast-steel cranks require much heavier pressures for the same press fit allowances, but how much heavier cannot at present be said.

V. With other conditions which cannot be formulated and which lead to erratic results in the observations and make it impossible to formulate a rule or construct a diagram which shall give other than approximate results. Among these are the nature of the surfaces as regards smoothness, the varying character of materials going under the same name, the shape of the crank and the speed with which the work is done. The term cast iron includes materials of widely varying hardness and other properties, and it is apparent that the web of a disk crank would have an influence not expressed by the radius of the hub. If a counterbalance were cast in the disk this and the crank arm would naturally produce an effect on the effective thickness of the hub which would be different from the effect of the arm alone on a plain crank. Again, with a plain crank, the arm, being taper, would reinforce a greater arc of the pin eye than of the shaft eye. Another factor, which no doubt introduces some of the discrepancies of the diagram, is that while most of the shafts were of steel, some were of wrought iron, and no discrimination between these materials has been made in the analysis. These considerations explain the erratic results obtained, but it is nevertheless plain that the observations follow the general direction of the curves in a very marked manner. The plotted observations, it should be remarked, are in most cases the averages of many. The figures attached give the percentage of radial hub thickness to plug diameter. It will be observed in this connection that the discrepancies grow less as the diameters increase. This is doubtless chiefly due to the fact that the percentage of error is always greater with small experiments than with large. Its effect is to give increased value to the diagram when used with large sizes where it is most needed.

Of course the holding power of these fits is the real thing desired, but it is obvious that the probability of adequate experiments being undertaken to determine this in large sizes is slight. The problem as it presents itself in the shop calls for the determination of the press fit allowance to give a required pressure in forcing the parts home, and this the present diagram solves better than any other data on record and with a degree of accuracy sufficient for most purposes.

In order to reduce the size of the diagram, the portion applying to diameters above 13 inches has been detached and placed at the right. For these large sizes the observations are too few to justify the drawing of more than one curve.

The lubricant used in all cases was linseed oil.

We should be glad to receive comparisons between this diagram and records by other observers. Such comparisons, however, to be of value, should include all the variable quantities named above as included in these observations.

The following example illustrates the use of the diagram: Diameter of plug 8 inches, length of fit 6 inches, diameter of hub 16 inches, press fit allowance .020 inch. Required the pressure to force the parts together.

$$\frac{\text{Radial thickness of hub} = 4 \text{ inches}}{\text{Diameter of plug} = 8 \text{ inches}} = .5$$

Finding a point on the 50 per cent. curve opposite 8 inches and tracing downward, we find 52 pounds. Area of fitted surface $= 8 \times 3.1416 \times 6 = 150$ square inches,

$52 \times 150 \times 20 = 156{,}000$ pounds

$= 78$ tons.

Directions for Use.—Select the curve which gives the ratio of the radial thickness of the hub divided by the diameter of the plug. Below the point of intersection of the plug diameter line with the selected curve read pounds. Multiply this reading by the area of the fitted surface in square inches and by the number of thousandths of an inch allowed for the press fit. The result will be the pressure in pounds carried to force the plug home.

American Compressed Air Tools in Great Britain.

The London correspondent of the "Glasgow Herald" says: "I understand that it has been arranged to give a very complete demonstration in some of the Clyde shipbuilding yards of the compressed air tools now being extensively adopted in some of the principal works in the United States. These tools are used not only for riveting, but also for chipping and caulking, work which may be described as the most arduous associated with shipbuilding. These tools are very light, and as they strike with a succession of blows of great rapidity, they closely resemble the manual method. But there are doubts as to their application, all of which will be investigated when the tools arrive in the Clyde district. With them will come a large squad of the best American shipbuilding yard workers to show off their skill and the efficiency of their tools, and it goes without saying that their advent will create great interest. I need scarcely mention that the riveters do the work at a much cheaper rate even than piecework; but it should not be forgotten that Mr. Rowan has introduced an electric riveter into the Clyde works which is giving very satisfactory results. Electricity is so universally used for lighting that no extra machinery for generating power need be installed; whereas for the pneumatic tool compressed air plants may not be so widely or so conveniently installed. Any shipbuilder, I may add, can have the loan of the plant after the demonstration to try the machinery under any condition he chooses."

Band-Sawing a Bevel Pinion.

BY W. H. FREEMAN.

I had to make a 4½-inch faced bevel pinion to match a bevel gear about 3 feet in diameter. The outside pitch was 1¾ inches, and the depth of tooth 1½ inches, the pinion to be shrouded to the points of teeth, as shown in Figs. 1 and 4, and to have thirteen teeth. I first laid it out full size on a board, as shown in Fig. 1. As the small ends of the teeth in the pinion were in the same plane as the inside end of the body, it was not necessary to turn it in the lathe to shape. A piece of timber was cut so as to make it out of the solid, with the grain running parallel to the axis. After planing to thickness, marked *a*, Fig. 4, the centers being marked on both ends, the teeth were laid out on the large end, the ends being beveled after the teeth were finished to shape, so that allowance was made for the distorted shape on that plane. As the gear which the pinion was to mesh with was worn, refinements as to shape of teeth were out of order.

On the board was described the arc *a b* from center *f*, Fig. 1. Then to this sweep was turned a concave piece, shown at *c*, Figs. 1 and 2, a little larger in diameter than the small end of the pinion, over the points of the teeth, and of exactly the same thickness, shown between arc *a b* and pinion, Fig. 1. A hole was bored in the center, while in the lathe, to fit a small wire nail. To the same sweep was turned up a convex piece of wood of sufficiently large diameter to carry piece *c*, with its load *D*, having plenty of room between the saw and the table, not forgetting the corners at the beginning of the sawing, as shown dotted in at *G*, Fig. 2. The exact center was marked on this convex piece while it was in the lathe.

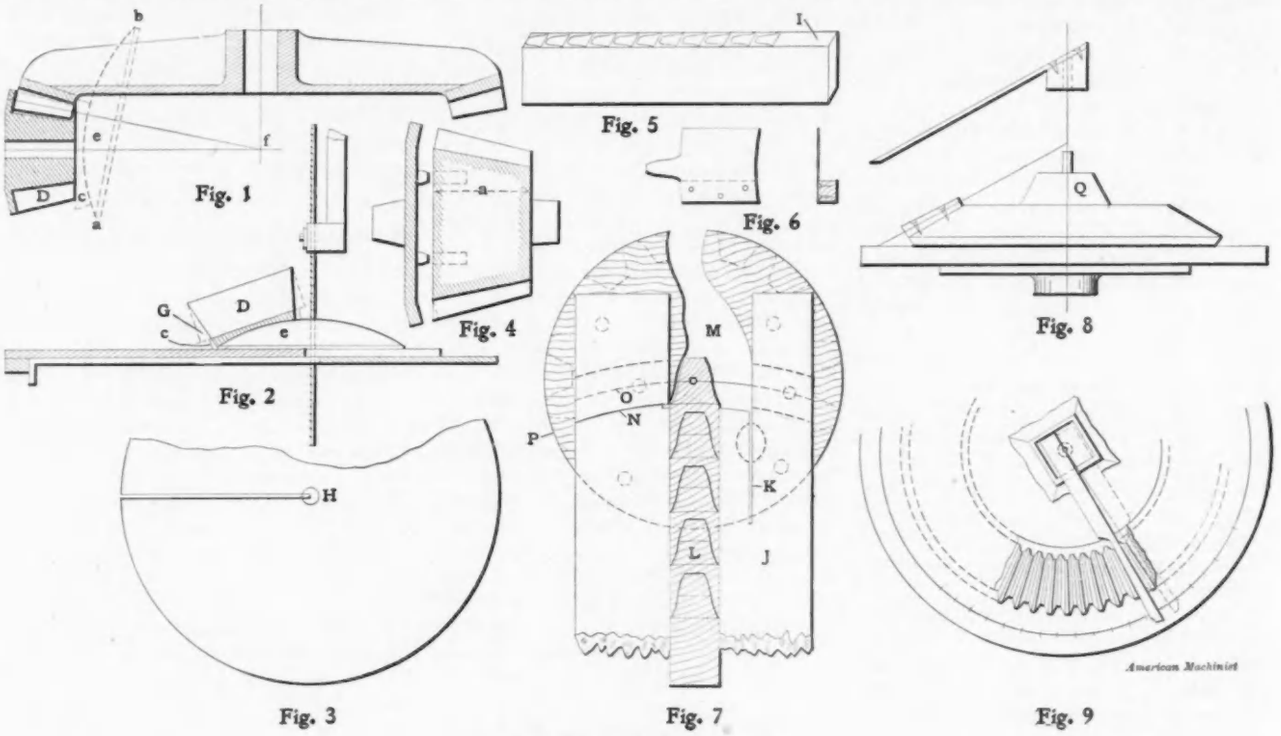
A piece of board that fitted the band-saw table without liability to change position (kept for general purposes) was placed there; the convex piece was fastened on it so that the saw cut exactly through the center marked on the piece in the lathe, as shown at *H*, Fig. 3. Taking the pinion block and fastening the concave piece *C* on the small end of the pinion block, centrally (by means of small nail and center) and securely, it was first sawed round the points of teeth, removing the curve *G*, then the teeth were sawed to shape, just splitting the lines. The bottoms of the spaces were finished by chisel, and the fillets by gouge. They were then all sandpapered smooth, and the large end of the pinion beveled off to fit the shroud turned for it, as shown in Fig. 4. The prints were fixed, the shroud pinned with large and small pins (Fig. 4) and the whole varnished and finished—an easy and superior job in 7½ hours.

Of course, if the bevel pinion was to have been recessed, so as to make the small ends of the teeth square with pitch line, the method described would have had to be modified, the end of the pinion turned, and the concave piece turned to fit the recess.

A similar method can be used for shaping the teeth of bevel gears, using the same or similar concave and convex pieces as were used for the pinion. Of course, the teeth would have to be made separately, and fastened on the body of pattern, previously turned to receive them.

Pieces sawed off a plank the full width of the tooth are planed up to a thickness equal to the length of the teeth. Then the teeth are marked off on the end grain, which is crosswise of the piece, as shown in Fig. 5; a template shown in Fig. 6, preferably made of zinc, being used for the marking. The end unmarked at *I*, Fig. 5, is a surplus on each piece. On the back or flat side of the concave piece fasten two blocks of the same depth as the length of the teeth and separated equally on each side of the center, sufficient for pieces like Fig. 5 to move easily between. After marking off pitch, point and root lines on both blocks, block *J* comes off, and saw-cut *K* is made, so that by wedge or oval pin or similar means, piece *L* can be held firmly while being sawed, replaced and teeth sawn; a portion of the concave piece being sawn out to give room for saw to work, *M*, Fig. 7. Each tooth is set by the root line *N*. Of course, pitch line *O* exactly passes through the center of the concave piece. The results show better teeth than by chisel and gouges, in much less time, always supposing the saw suitable and in first-class order. The dotted tooth lines on concave piece *P* represent it as the shape it would appear after sawing pinion on it. By this method all screwing of blocks while being sawed, and the fitting of blocks on the body of the pattern are avoided, also the small ends of the teeth take care of themselves without laying out.

Now for the method of putting the teeth on, which also has proved a labor-saver: When the body of the pattern is being turned in the lathe a block of wood,



BAND-SAWING BEVEL GEAR TEETH.

with pin *Q*, Fig. 8, is fixed so that the pin runs true and just short of the pitch cone. Another smaller block is bored to an easy fit on the pin and cut off on the bevel, so that a straight-edge, when fastened on the bevel and cutting through the center, coincides with the pitch cone line on its upper edge.

By letting the end of the straight-edge run down to a circle on the chuck face, divided into as many parts as there are teeth, every tooth can be fastened on square and at the right pitch; and if two straight-edges are used together as shown dotted in Fig. 9, the chances of error are still further diminished.

The slight error in the size of the small end of the teeth, introduced by the thickness of the saw kerf, amounts to very little. The saw being 3-64 inch in kerf in present case, the pinion 4½ inches long in tooth, the large wheel 18 inches radius (more on pitch cone), the error amounts to $\frac{3}{64} \times \frac{4\frac{1}{2}}{18} = \frac{3}{256} = \frac{1}{85}$ inch, or rather less; being all the better for cast wheels, as it ensures the strain coming where it can be better withstood. The small ends of teeth are more likely to be abnormally larger, by rapping and additional pressure of metal.

Of course, if thought desirable, this small error can be eliminated by making the corner of the saw kerf exactly through the center of the convex piece, and sawing one side of teeth first, then adjusting convex piece so that the other corner of kerf cuts exactly through center, then sawing the other side of teeth.

Sydney, New South Wales.

A New Friction Clutch.

The half-tone, Fig. 1, shows a pulley, with a friction clutch for driving it, which has been designed especially for use in connection with gas, gasoline or oil engines. It is well understood that it is difficult to start these engines with the driving load on, and this device affords a convenient and ready means of throwing the load either on or off as desired, and whether the engine shaft is running or at rest. It will be seen that the clutch is applicable to other service where the conditions are similar.

The operation of the device will be understood upon reference to Fig. 2. The main piece or sleeve *A* sets over the projecting end of the shaft, and is fastened to the hub or arms of the fly-wheel by the round head cap-screws, as shown. The pulley *B*, when not clutched, turns freely on *A*. It is clutched when required by pinching the hub endwise between the shoulder *a* of the sleeve *A* and the face *b* of the sliding cap *C*. This sliding cap *C* has a long hub, upon the inner end of which are fulcrumed the right-angled levers *c c*, the long ends of these levers lying approximately parallel with the axis of the shaft, while the short ends of the levers bear against the points of screws *e e* tapped into the inwardly projecting flange of sleeve *A*. The spindle *D* slides freely in the hub of the sliding cap *C*. The inner end of *D* carries two friction rollers which bear against the long arms of the levers *c c*, the jaws between which the rollers are carried lapping over the sides of the levers and causing the spindle to turn with the other parts. The shape of the long ends of the levers is such that when the spindle *D* is drawn outward, carrying the rollers with it, the long arms of the levers approach each other, and the short arms recede from the points of the pressure screws. When, however, the spindle *D* is thrust inwards, to the position shown, the long ends of the levers are distended, pressure is brought to bear against the ends of the screws, and the effect of this is to draw the sliding cap *C* inward and to cause the face of it to pinch the hub of the pulley. The screws *e e* are adjustable to secure the necessary pressure. They are held from turning by jam-nuts, as shown, or the heads of the screws may be notched, with the points of radial screws ngaging the notches and holding the screws securely. The long arms of the levers are of such a length and shape as may be required to apply the pressure gently, yet effectively. Whatever the position of spindle *D* the levers are normally held in contact with the rollers by means of the springs which are shown in dotted lines. The hand-wheel on the outer end of spindle *D* is used for thrusting the spindle inward or outward. It is loose on the spindle but securely held between two shoulders. When the shaft is rotating and it is necessary to operate the spindle *D*, to throw the clutch in or out of grip, the hand is laid upon the wheel, when it at once stops turning, and may be taken hold of to make the thrust in either direction, as desired. This clutch is made by Ball & Corbett, 39 Cortlandt street, New York City.

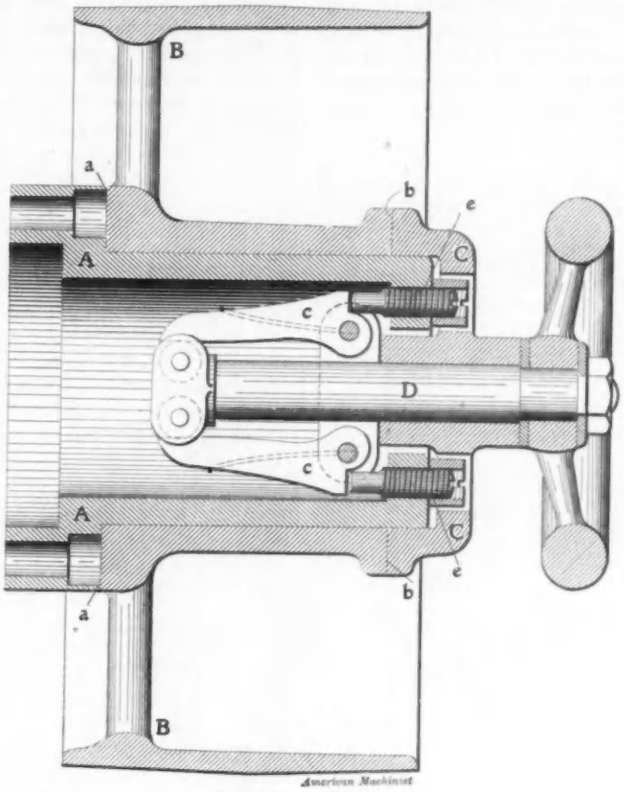


Fig. 1
DETAILS OF CLUTCH.

Die Construction.

BY GEO. B. PAINTER.

In the "American Machinist" of February 23 I gave a description of a combination punch and die for piercing, shearing, bending and forming a piece of sheet

A NEW FRICTION CLUTCH.

metal. The present article illustrates a die for shearing and drawing a piece of sheet metal into the form of a cup with irregular edges. The principle of the two dies is identical as far as the automatic feeding of the strip of metal is concerned. In details of construction and operation they differ. The finished piece, being entirely different from the previous one, calls for a different combination of mechanical movements. The arranging of combinations of mechanical movements, guided by a knowledge of how a piece of metal will act under different conditions, constitutes up-to-date die-making in certain lines of work.

A, Figs. 1, 2 and 3, is designed to show a cast-iron die-bed carrying the slide *B*. The grip *C*, its connection to the press and method of operation are identical with that in the reference before given. In this instance it is necessary that the piece of metal that forms the finished article be severed from the strip before any action of forming takes place. The shearing die *D* is therefore raised above the level of the drawing die *E*, and slotted to accommodate an auxiliary slide *F* made adjustable by means of the shoulder screw *G*.

The strip of metal passing between the shearing die *D* and the stripper gage *H* has the notches cut by the shearing punches *I*. Feeding the length of one blank, the final cut is made by the shearing punch *J*. This punch is provided with a pin *K* held out by means of a very sensitive spiral spring; just enough spring being provided to insure the fact that the blank after being severed from the strip, will not draw back, but will lie in front of the slide *F*.

Upward movement of the ram carries the strip of metal forward for another blank, and the blank already cut is carried over the drawing die *E*. The projections *M* 3, which are part of the gage *M*, are beveled upwardly in front of the cutting die *D*, and are to insure the blanks taking their proper position.

The extent of the lateral feed is regulated by means of the screw *G* in connection with the slide *F* and the stop *I*, which is slotted into the gage *M* and made adjustable by means of the screw *M*¹. Side gaging is taken care of entirely without adjustment, as this depends on the width of material which is being worked, and to get good results from dies of this description it is necessary that the width of material be uniform.

The eccentric *X* is to prevent withdrawal of the strip on the outward stroke of the slide. The arrangement of the pad *P* actuated by the soft rubber cushion *Q* was made necessary by the fact that the shell had to be slightly concaved on the bottom. If the shell had been flat, an ordinary push-through drawing die would have answered the purpose. The action of the pad *P* insures the fact that all of the shells will stick to the drawing punch *T*. This necessitates the addition of the stripper plate *U*, which travels on the studs *V* and is held upward by means of the spiral springs *W*. The travel of the ram of the press being more than the travel of the stripper plate, continued upward movement of the punches insures the stripping of the shell from the punch, and

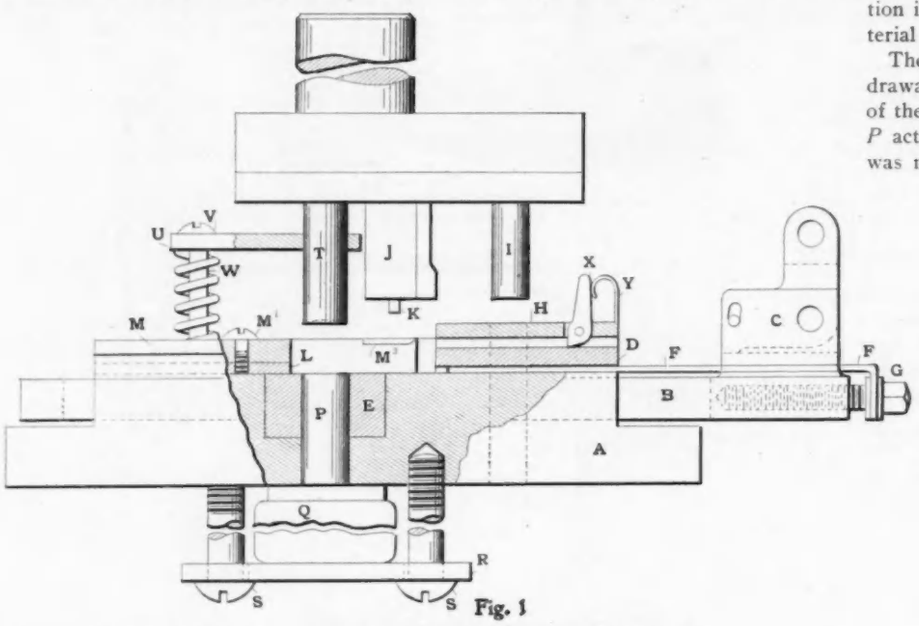


Fig. 1

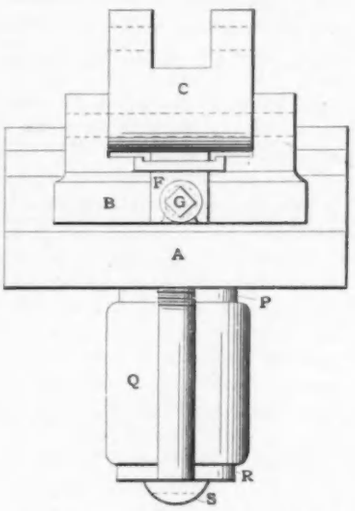


Fig. 2

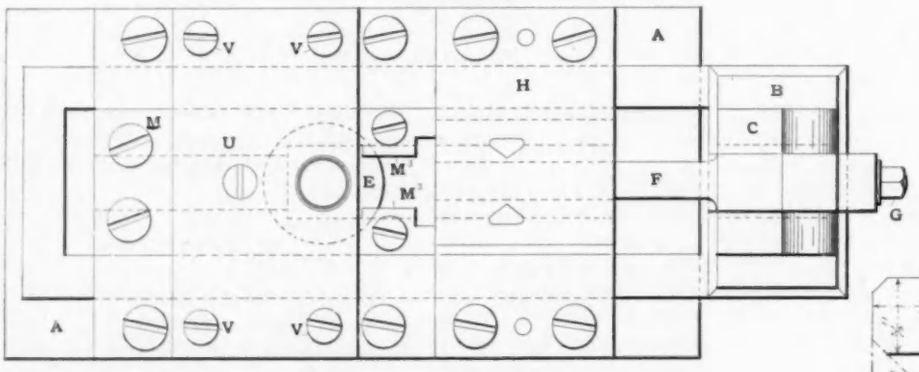


Fig. 3

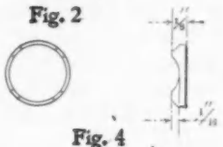


Fig. 4

Fig. 5

DIE CONSTRUCTION—A PUNCHING AND DRAWING OPERATION.

the press being set on an incline gravity causes the shell to fall back of the die.

The lubrication of the drawing die *E* must be done by a small tube (not shown) leading from left to right on to the drawing punch *T*, as the perfect working of this die depends upon keeping the shearing punches as dry as possible. A mixture of nine parts soap water and one part lard oil makes a good lubricant for drawing shell work.

The production of the die illustrated and described is 65,000 pieces per day of ten hours, and perhaps the best thing I could say about its method of construction would be that this particular die has produced, up to date, 9,300,000 pieces, without any perceptible wear, except of course to the drawing dies and punches; these parts must be renewed for every two or three hundred thousand pieces. The cutting and feeding parts after this enormous production show no great amount of wear. The question may be raised here, would it not pay to make a gang die and multiply the production at each stroke of the press? I am not in favor of multiple drawing dies, except in special cases, and I shall leave that question to be decided by the man who is responsible for the production.

Workmen's Indemnity in France.

Consul Brunot, of St. Etienne, sends the following abstract of the law which went into operation June 1 relative to accidents to workmen in France:

Indemnity Accidents.—Accidents occurring in the course of work to workmen and employees in the following occupations: Building, workshops, yard work, manufactories, transportation by land and water, loading or unloading, shops, mines, quarries and every operation, in whole or in part in which are manufactured or handled explosive materials or in which use is made of motor power other than that of man or animals—give the victim, or those depending directly upon him, a right to indemnity at the expense of the head of the enterprise, on condition that the interruption of work exceeds four days.

Indemnity.—For actual and permanent incapacity, a pension equal to two-thirds the annual wages of the incapacitated; for partial but permanent incapacity, to one-half the difference between his regular salary and his reduced salary, occasioned by the accident; for temporary incapacity, a daily indemnity of one-half the wages of the incapacitated at the time of the accident, the indemnity beginning on the fifth day after the accident.

When the accident proves fatal, a pension is allotted on the following conditions to the persons stated:

(a) A life pension, equal to 20 per cent. of the annual wages of the victim, to the surviving widow (or widower), who is neither divorced nor separated, the marriage to have been consummated prior to the accident. Should the widow marry, she forfeits her right to this pension, but will be allotted three times the amount of her annual pension in one sum as a final adjustment.

(b) For the children, legitimate or natural, recognized before the accident, orphans of father or mother, under 16 years of age, pensions, calculated on the annual wages of the victim, of 15 per cent. of those wages in the case of only one child, 25 per cent. if there are two children, 35 per cent. if there are three children, and 40 per cent. for four or more children. For children deprived of both parents the pension is 20 per cent. for each child, but cannot exceed in the aggregate 60 per cent.

(c) If the victim leaves neither widow nor children, as per (a) and (b), each of the ascendants who depended on him will receive a life pension, and the descendants a pension up to sixteen years. This pension will be equal to 10 per cent. of the annual wages of the victim, but in no case can it exceed 30 per cent. These pensions (c) can be reduced proportionately, according to circumstances.

The pensions allowed in virtue of the present law are payable quarterly, and cannot be transferred, nor are they subject to seizure.

Foreign workmen, victims of accidents in France, who cease to reside in French territory will receive as total indemnity an amount equal to three years' pension; members of their families not resident in French territory at the time of the accident will receive no indemnity.

Employers are also held responsible for medical, pharmaceutical, and funeral expenses. The maximum funeral expenses cannot exceed 100 francs ($19.30).

Employers can relieve themselves, during the thirty, sixty, or ninety days following accidents, of the obligations of paying to the victims the expenses of the accidents and the temporary indemnities or parts only of these indemnities, as specified herewith following, if they can show—

(a) That their workmen have joined a mutual aid society and they (the employers) have paid their share of the subscriptions to such society by mutual agreement; but such share shall never be less than one-third tne total subscriptions.

(b) That such society assure its members, in case of accidents, during thirty, sixty, or ninety days, medical care and daily indemnity. If such indemnity is less than one-half the daily wages of the injured, the employers must make good the difference.

Full pensions and indemnities are allowed on wages amounting to 2,400 francs ($463.20) per annum; on all wages above that sum, pensions and indemnities are calculated at the rate of one-fourth the regular allowances.

Workingmen and employees cannot, by reason of accidents of which they are the victims in their work, invoke any other provisions than those of this law.

Independently of the action resulting from the present law, the victim, or his or her family, possesses the right to claim damages for the injuries caused by the authors of the accident other than employer or his workmen, according to the rules of common law. The indemnity allowed in such case will exonerate in the same proportion the employer from the obligation imposed upon him by the accident. This action against a third party (responsible for the accident) can be exercised by the employer at his own risk, should the family of the victim fail to prosecute.

At the time of the definite settlement of the life pension, the victim can ask that one-fourth of the capital necessary to establish such life pension (calculated according to the tariffs made out for victims of accidents, in the reserve fund for old age) be paid to him in money. He can also ask that his capital, less the one-fourth just mentioned, shall constitute a life pension for him, revertible as to one-half at most to his widow. The court in council chamber will decide these questions.

Consul Brunot says:

"I must state that the law has provoked a great outcry in the public press, while the heads of small industries assert that if it is enforced they will have to throw up their business altogether.

"The workmen are, naturally enough, well pleased at the guaranties given them in this law; but it is feared that the result will not be entirely to their benefit, as employers will, in order to minimize their risks, refuse, as much as possible, to employ married men, especially those with children, and will also give preference, especially in the border districts, to foreign workmen."

An Inexpensive Autographic Torsion Testing Apparatus.

BY ROBERT A. BRUCE.

The requirements of commercial testing have caused testing machines to be developed chiefly for tensile and compressive stresses to the comparative neglect of tests in torsion, although such tests are very easily applied, and for many purposes in mechanical engineering more is to be learned from them than from any other source, and the apparatus required is so simple that it would repay many engineers to construct it.

The particular design to be described is one of a number of possible types, and while it is not claimed that it is the best for scientific accuracy, at the same time it is claimed that serious sources of error are absent. Among the points which are to be kept in view are the following:

I. The torsion movement must be ap-

Fig. 2

Fig. 5

Fig. 3

Fig. 4

Fig. 1

AUTOGRAPHIC TORSION TESTING APPARATUS.

plied so that no bending stresses are induced in the material.

II. No longitudinal restraint to freedom must exist; that is, the bar to be twisted must be so held that one end is free to move in an axial direction.

III. The torsional moment applied and the strains induced by such stresses should be automatically recorded in the form of a diagram of such dimensions as to form a complete record of the test for future reference.

IV. The apparatus should be sufficiently powerful to fracture by torsion a bar of hard steel ½ inch in diameter.

The apparatus illustrated in Figs. 1 and 2 may be modified at will to suit any fairly powerful back-geared lathe of over 15 inches swing.

The test piece *a b c* is turned cylindrical for a length of about 13 inches and to a diameter of ½ inch, and the ends *a* and *c* are shaped square, a nicely rounded fillet being left at the change of section. For most purposes it is convenient to stick to a particular shape and size of test piece for purposes of record and quick comparison.

The square ends of the test specimen are held in grips *d* and *e*, made as shown in Fig. 3, or for uniform shapes of shank with simple square holes as shown in Fig. 4. One of the chucks *d* is screwed on the lathe spindle, and through it the torsional moment is applied by pulling round by hand, having put in the back gear and placed the strap on the largest cone. It is, however, merely a question of incurring a little extra expense to incorporate *d*, with a worm wheel screwed on to *f*, and turned by means of a worm and handle fixed in a small bracket clamped to the lathe bed. The grips *e* are held in boss *h* on the lever *g g*, which is a simple casting turned to swing easily but without slack on the footstock spindle. It is this lever *g g*, in conjunction with the springs *k* and *m*, which regulates the amount of the torsional couple applied to the specimen. The ends of the lever *g g*, which are arcs of circles concentric with the eye of the boss, are designed to ensure the constancy of the direction of the forces and the arm of the couple throughout the range of extension of the springs. The springs *k m* should be as nearly as possible of identical material, temper and dimensions, since on their quality depends the absence of friction between the boss of the lever and the footstock spindle. A small counter weight *W* can be fixed in any convenient position on the lever *g g* for the purposes of balancing the pulley *p* and the attachment *o* and spring *m*.

The springs are connected to the lever *g g* by very thin and flexible strips of steel (strips .01 inch thick and 1 inch wide are ample for the size of apparatus here described). It will be seen that the load is applied and the yielding of the specimen allowed for by the slow movement of rotation of the lathe spindle through the medium of the back gear, while the extension of the springs is a measure of the twisting couple applied. The paper is most conveniently attached to the surface of the barrel *R* by means of a little india rubber solution (which is very clean stuff to handle and which allows of easy removal of the paper and its subsequent cleansing by wiping with a rag saturated in naphtha, which quickly dries off and leaves the paper quite clean).

The barrel *R* is concentric with and attached to a tube *s*, which again is recessed into and soldered to a flanged bush provided with three set-screws, one of which *u* appears in Fig. 1, for the purpose of clamping the tube *s*, and consequently the barrel *R*, to the test piece. Great care must be observed in getting the test piece and tube concentric, and for this purpose two of the set-screws are made with blunt points and one with a hardened sharp conical point; or split disks, shown in Fig. 5, may be advantageously used. The inner tube *t* slides easily, but without slack, in the tube *s*, and it is recessed into and soldered into the casting *w w*, the boss of which is provided with three set-screws, one of which, *v*, is shown, for the purpose of connecting it to the test piece at a known distance from *u*. This distance may be conveniently made 12 inches. The turned rod *x* is fitted to the two arms *w w*, so that its center line is parallel to the center of the tubes. On *x* slides a small casting *z*, to which is attached a pencil pointing normally to the surface of the paper. A small counter-weight sliding on a rod attached to the pencil holder causes the pencil to press with the required pressure upon the paper.

It is therefore evident that as the specimen twists the distance moved by the pencil round the circumference of the drum is a measure of the angle through which the specimen between the set-screws *u* and *v* twists. A string or fine wire passing over the pulleys shown causes the pencil holder *z* to travel along *x* against the pressure of the light spring *y* towards *w*.

The amount of its travel in this direction is determined by the deflection of the springs *k m*, being in point of fact rather more than double the deflection of the springs, as will be readily understood by following the course of the string and noting its attachment *a* to the lever *g*, its change of direction round the pulley *b* and its passage over the pulleys *p* and *c* to *z*.

The movement of the pencil towards *w* is therefore a measure of the twisting couple; and if the sum of the forces required to extend the spring a known amount be determined experimentally, the callibration of the scale of twisting moments is easily accomplished.

The radius of the surface of the paper on the barrel may be very conveniently 5 inches.

It is obvious that in order to keep the twisting couple constant when the same springs are used on different specimens, the set-screw *v* should grip the specimen *b* as near as possible to the square and stiffer portion *c*, so that the rotation of *w*, relatively to *c* is small. The radius of the arcs on which rest the flexible steel strips may conveniently be made 12 inches.

At *d* is shown a rubber buffer to prevent excessive shock at the time of fracture of the specimen.

Some Constants for Use in Designing Elliptic Springs.

BY F. F. GAINES.

In this article the writer does not intend to introduce anything new in the formulæ for designing elliptic and semi-elliptic springs, but to add to existing formulæ some constants which have proven their correctness and value. Reuleaux's formulæ give as good results as any, being absolutely correct in some cases. The fact that they are not always reliable

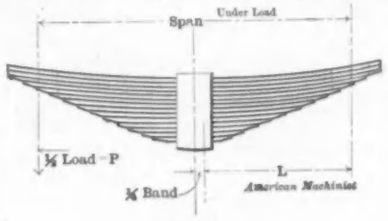


Fig. 1

SEMI-ELLIPTIC SPRING.

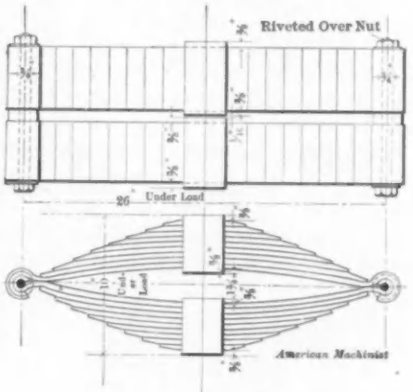


Fig. 2

FULL ELLIPTIC SPRING.

caused a friend of the writer to make extensive investigations, the results of which are now made public.

For a clearer understanding of the use of the constants, modifications of Reuleaux's formulæ are given below:

$$P = \frac{S\ n\ b\ h^2}{6\ L} \qquad (1)$$

$$n = \frac{6\ P\ L}{S\ b\ h^2} \qquad (2)$$

$$D = \frac{6\ P\ L^3}{E\ n\ b\ h^3} \qquad (3)$$

Substituting in equation (3) the value for P given in (1), (3) becomes

$$D = \frac{S\ L^2}{E\ h} \qquad (4)$$

In the above formulæ the symbols used have the following values:

P = Maximum static load (on one end of a semi-elliptic, and half maximum load on band of full elliptic spring).

S = Allowable stress in pounds per square inch, varying with the thickness of the plates, as follows: For ¼-inch plates, 90,000 pounds; for 9-32 inch plates, 86,500 pounds; for 5-16 inch plates, 84,000 pounds; for 11-32 inch plates, 82,000 pounds; for ⅜-inch plates, 80,000 pounds; for 13-32 inch plates, 78,300 pounds; for 7-16 inch plates, 77,000 pounds; for 15-32 inch plates, 75,750 pounds; for ½-inch plates, 75,000 pounds.

b = Width of plates (inches).

h = Thickness of plates (inches).

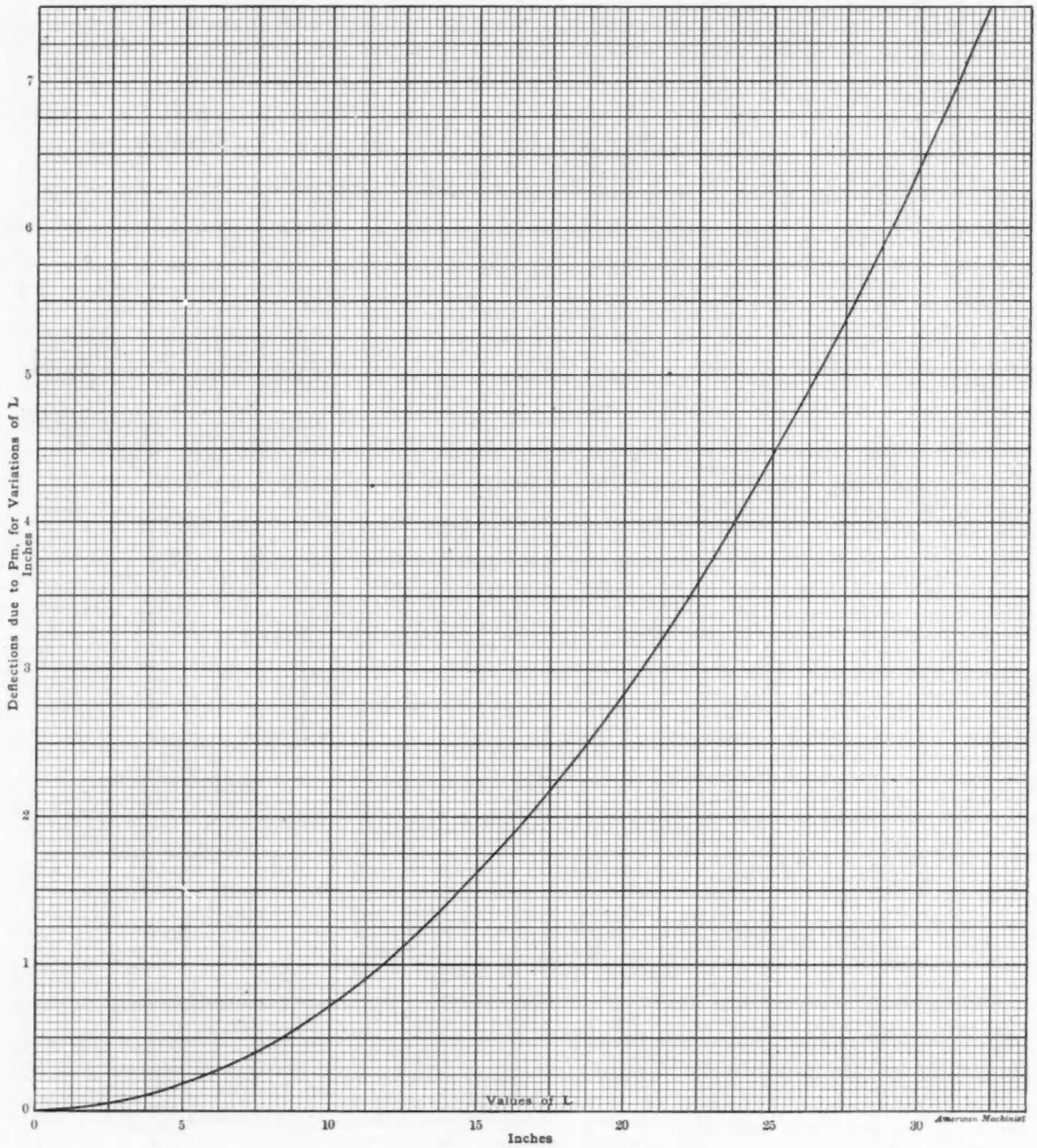


Fig. 3

Curve for obtaining deflections due to P_m with ⅜-inch plate and variations of L.

$$D = \frac{S L^2}{E h}$$

$S = 80{,}000$ pounds.

$E = 30{,}000{,}000$.

$h = \frac{3}{8}$.

Hence $D = .00711\ L^2$ is the equation of the curve.

n = Number of plates.
L = Half span, less quarter width of band (inches). See Fig. 1.
E = Modulus of elasticity = 30,000,000.
D = Deflection for semi-elliptic, and half deflection for full elliptic springs.

In addition to the foregoing, the width of the band should be about one-tenth the span, to nearest ¼ inch; that is, a spring with 32-inch centers should have a band 3¼ inches wide. The number of full-length leaves to be used and the length of shortest leaf depend largely on the service in which the spring is to be used. The greater the number of whole leaves, the stiffer the springs. As a rule, for regular elliptic springs, there should always be two plates full length, and where more than two full-length plates are used, the last should be tapered. For average service about one-fifth the total number of leaves should be whole leaves, the remainder being regularly shortened. For full elliptic springs, the second leaf should extend to the fillet of eye, the remainder being regularly shortened, as in Fig. 2. It will be noted that the constants referred to are the departures from the customary values of L and S. Some spring makers hold that the length L used for calculation should be measured from the center of the band, as the band, while binding the leaves together, does not hold them tight enough to prevent flexure. Again, others claim that the band makes that portion of the spring rigid, and that the length L, for use in formulæ, should be measured from the edge of the band. As a compromise between the extremes, springs figured with half the disputed distance included give good results; so that for all practicable purposes a value of L = ½ span − ¼ width of band, works well. An investigation of broken springs will show that the majority break between the center and edge of band, which demonstrates the correctness of the assumption as to length.

As regards the value of S, the allowable stress per square inch, the generally accepted figure for all thicknesses of plates is 80,000 pounds. This value, while averaging up for all thicknesses fairly accurately, does not hold out in individual cases, nor is it logical that it should. The more steel is worked, and the more homogeneous its consistency, the greater its strength. Thus a plate ¼ inch thick would appear to be more thoroughly worked, and on account of its thickness be more evenly tempered throughout, than a plate ½ inch thick. The result of investigation has conclusively proved this, and led to the adoption of the values given for S.

Theoretically, the values of the modulus of elasticity should be proportioned to the respective values of S, but in practice the correction is so small as to be negligible.

To those who have occasion to design springs, many graphical methods of applying these formulæ are available. I will mention one which has been found useful. In equation (4) it will be seen that the deflection under maximum load = $\frac{S L^2}{E h}$; so that for the same thickness of plates, the deflection under maximum load is proportional to L^2, the fraction $\frac{S}{E h}$ being a constant. By calculating the value of D for several values of L, a curve may be plotted with L as one ordinate and D as the other. Fig. 3 shows such a curve for plates ⅜ inch thick. Such curves are simpler to construct and more easily handled than tables giving the same information. For loads less than the maximum (the deflection being proportional to the load) the deflection is easily found by proportion.

There are many rules in existence for obtaining the test load, and where such load is required, a simple and reliable one is: Make test load 1¼ maximum static load. This on an average gives a stress of about 100,000 per square inch, which is probably the limit of stress due to vibrations under load.

The lightest spring, and hence the cheapest, is that having a narrow width of leaves, while the best riding spring is made by the use of wide leaves. Thick plates are conducive to easy riding and long life, while thin plates are cheaper in first cost, due to higher allowable fiber strain, thus making a lighter spring.

Working, tempering and quality of material make such a difference in the strength of a spring that not all springs bought on the open market will check accurately with these formulæ; but, on the other hand, springs designed by them can be furnished by any reputable spring maker, so as to fill the specification and give entire satisfaction.

Office of Mechanical Engineer, Lehigh Valley Railroad.

Letters from Practical Men

From the Other Hemisphere.

Editor American Machinist:

I am an old subscriber to your "missionary tract," formerly in San Francisco, and later here in Sydney, New South Wales, through news-agent. There may be nothing new under the sun, but I doubt it. Even if true, it's quite as good as new to me, what others are doing, if I am not acquainted with it before; and if methods come to my knowledge that are superior to what I have known before in that line, I feel better for it, and hate to hear someone say "that's old."

What I forward to you is entirely original with me, but may be common with others, and having never seen it mentioned in my "American Machinist" or other technical literature, I send it for the benefit of those who may not be above benefiting by it. Some of my acquaintances have told me I was a fool to put others up to wrinkles, such as the ones I send you; but I think differently. They fancy by such closeness they get a better show in the trade; but it all evens up to the same standard, if most of them are on the same tack; and where is the pull then? I want more wages, and fancy that any "golden rule" boss will give it to me if I also cause him to receive more profit at the same time, and it is only by reducing cost of work more in proportion than any rise in wages that it is possible. Also the less the patterns cost in making the less hesitation there would be of having them made, consequently more work and steadier billets.

While "on the floor" I would like to point out the "pigheadedness" of many bosses in not providing the best facilities in the pattern shop to reduce cost of work, but on the contrary, begrudging any money spent in the "necessary evil" department. Making the shop comfortable to work in is one thing, then plenty of first-class necessary apparatus and materials, and, last but not least, good lavatory arrangements, for we must wash hands often. W. H. FREEMAN.

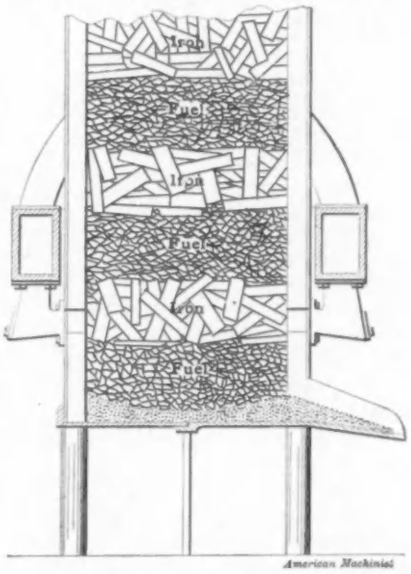
Rookwood, Sydney, New South Wales.

[The above interesting letter accompanied the article on "Band-Sawing a Bevel Pinion Pattern," which appears on another page of the present issue. Our correspondents are not the less welcome, but rather a little more so, when they address us from the other side of the globe. The article from the Antipodes requires no allowances on account of its distant origin. It is every way as good as if it had been produced here at home. —Ed.]

High-School Foundry Instruction.

Editor American Machinist:

I enclose a sketch representing a picture recently seen displayed—and it was a very fine piece of work on the part of the



HOW NOT TO CHARGE A CUPOLA.

artist—on the black-board of a manual training school in a growing city of the West. Being on a visit to that city, a friend who is a resident, and who is also a veteran foundryman, invited me to attend with him the graduation exercises of the manual training school, the High School. This, like all up-to-date schools of this kind, had the various mechanical departments, and among them a foundry. Both being foundrymen, we naturally wandered into that room to examine the apparatus for giving practical object-lessons in the art of founding. The "practical" instructions were principally given by making molds, then breaking them up and molding again, with an occasional casting of lead into some form or other. But in theoretical instruction in founding, the instructor was unrestricted. As the sketch shows, he soared into realms that he knew but little of, and he certainly had no fear.

The cupola sketch attracted at once the attention of the experienced eyes of the foundrymen, and the following comments resulted: "How is he going to drain the cupola of all the iron before dropping the bottom?" asked one. "The way the fuel and iron are charged in, with iron in front of the tuyeres, he never will have any fluid iron to drain out," said the other.

My friend hunted up the foundry instructor at once. To let so flagrant a violation of the fixed and irrevocable laws of cupola practice go unchallenged was not to be thought of. Even if the crime was only a chalk talk, to my old foundry friend it was sacrilege of an aggravated type. The instructor was shown the heinousness of his offending. Sarcastic fingers were pointed to the damning fact that iron was lying in front of the tuyeres, and would never melt. A broadside was fired at him. If the cupola was charged as it should be, it could not be drained of all its iron, a very necessary thing to do, to prevent the operator from getting burned when the prop was knocked out from under the doors. Insurance rates would advance at once if such a bottom was dropped in any section of the town the foundry was, and a lot more advice was proffered.

The instructor was evidently a man of resources. After a moment of mental staggeration (to coin a word), he looked at each of us with an "Oh-how-tired-I-am" expression, and asked if we thought there was not a lecture given in connection with that cupola sketch, wherein the whole philosophy of cupola practice was fully elucidated, both mechanical and chemical action of the forces of heat units, carbon, carbonic oxides, oxygen, etc., etc.

Yes, Oh! yes. We have no doubt but that the lecture was elaborate and exhaustive, but we could not but feel that a picture is made to, and does, convey a more lasting impression than can be produced by language, however elaborate the explanations and however frequent the mental flourishes; and being practical foundrymen, we thought we could be of service in making the crooked straight and the rough places smooth. Especially in a case as plain as this seems to be, if the picture does not tell the truth, then it is more pernicious in its effects than useful. It may seem strange, but that foundry instructor did not even thank us for trying, as we thought, to throw light into evidently a dark place.

L. C. JEWETT.

North Attleboro, Mass.

Marking the Edges of Draftsmen's Curves.

Editor American Machinist:

Enclosed blueprint has been made from a transparent celluloid curve; the letters on the same were written with Higgins ink to facilitate the recovery of a certain section when inking a tracing. It is a standing annoyance to find a proper curve with these instruments, and when inking to repeat the same process. This manner of indexing all such instruments greatly aids their usefulness. When the desired curve is obtained denote on drawing as follows: 16 *i*, which means that instrument 16 and section *i*, between *j* and *h*, were used. These letters may be indented with steel stamps without breaking the instrument, and are preferable to figures for obvious reasons, namely, to avoid mistakes of measurements. The sharp contour line in the blueprint is due to blackening the edge with ink before printing.

EUGENE MOTCHMAN.

[The blueprint referred to by our correspondent is reproduced here as a wax process cut, Fig. 1. The proposition to divide the curve into sections is a good one as far as it goes, although not at all new, and it is our experience that the marks should be much nearer together—so near, in fact, that the alphabet would be inadequate for their designation. If the marks were, say, ⅛ inch apart, and numbered by fives or tens all the way around, it would be easy then to designate by pencil on the drawing the portion of the curve to be used in each case, so that there would be no lost time in finding the precise position again when inking. Thus, the outline of Fig. 2, which is offered as an additional suggestion in line with that of our correspondent, is composed of eight distinct curves, each of which is here designated by a letter, and the longer ones are marked with a series of numbered graduations. If in a particular case *B* 7-19 was used, or *D* 36-17, these lines could be found again without error and without delay. As it is not at all necessary that these marks should be equally spaced, the scheme may be tried by anyone who has a celluloid curve by merely inking and

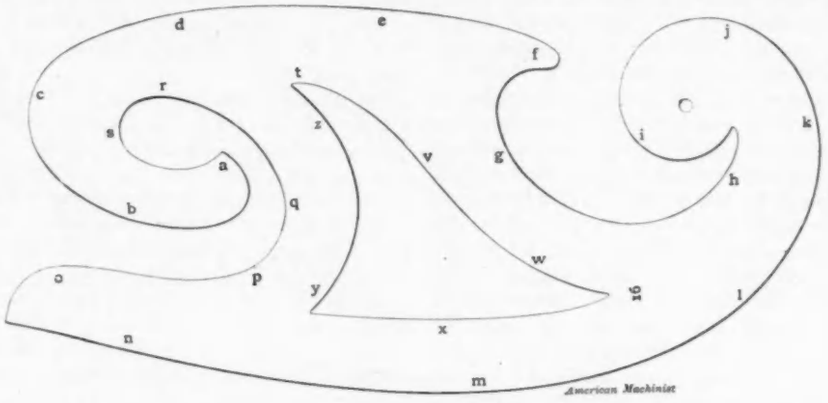


Fig. 1

TO LOCATE A CURVE.

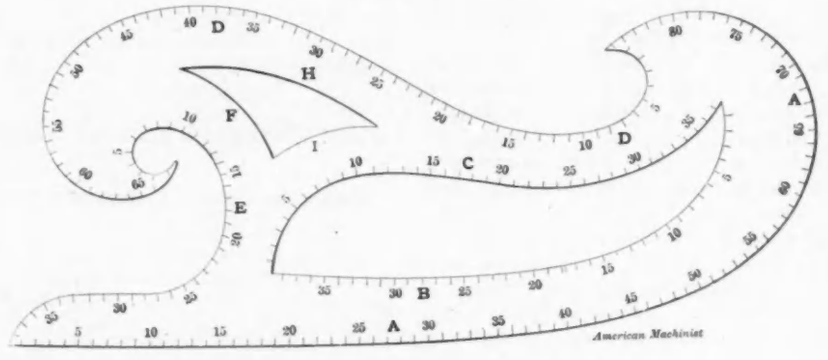


Fig. 2

A MORE PRECISE ARRANGEMENT.

numbering the marks by hand. Professor Sweet wrote of this matter in his articles on mechanical drawing in the "American Machinist" in 1881; but when he wrote, the day of the celluloid curve had not yet come, and he was obliged to speak of the necessity of marking both sides of the curve, and of having the opposite marks to correspond.—Ed.]

An Experimental Shop.

Editor American Machinist:

One thing the company made was patent bung holes; made them on semi-automatic machines, a form of dial feed press, and took four boys for each press—one, known as the runner, had charge of the work, and the others were helpers for him.

The company had the experimental fever and had it bad. In the machine shop connected with the works a man would be working on parts of the machines to put the bung holes on with, half a day, perhaps, and the rest of the day would be put at experimenting with a new form of bung hole. There were about forty machinists employed, and most of them were worked on this plan. A man was seldom given the same part of a machine twice in succession. The superintendent was always growling about the cost of the work; and there wasn't even a board to be seen of that "high fence" that Chordal once wrote of as necessary to keep the manufacturing and the "high art" part of the business separated. Among other things experimented with, was the help upon the aforesaid presses. First it was boys; $4 per week for the runner; $3.50 for each of the others. Then a few of the best boys were given $4 each per week, but only three of them to each machine. There were but two machines run this way, and the boys by lively work managed to get out the amount expected from the machines—about 500 gross per day.

Then the fever struck the company and they discharged all the boys and tried girls instead. Each girl was to have $3 per week at the start, and to be advanced to $3.50 at the end of a month, if she proved to be a good hand.

Next they tried forgetting to give them the advance at the end of the month, and finally, did not promise a new hand any advance in the future.

This did not work well, as a new girl soon caught on, and did not see the use of trying to become expert at the work when it was not going to give her the same wages as the older hands, even though she should do as well, or better, than they. The girls were apt to get their fingers jammed, and when on a final occasion one of them had her thumb badly mashed and did some pretty tall yelling, seven more of the girls fainted and broke up the whole gang for the rest of the day. This settled the girls, and the company tried it again and put boys on once more.

A few boys that had formerly worked there were given $3.50 per week to be runners; all new boys $3 per week. Naturally when a new boy was given a machine to run he thought he ought to have the same pay as the old runners got, when he could do as well with a machine as they.

The company did not look at it that way, however, and it soon created ill feeling among the boys. When a dull season came on and some boys had to be discharged the foreman of that floor turned off some of the older boys that were getting the higher wage, as they had not proven to be as good runners as some of the new boys. Business getting good again these old hands were hired by the superintendent and given their old rate of $3.50, and that made trouble at once. The other boys went in a body to the superintendent and asked for more pay, but were refused and ordered out of the office. Within a week about a dozen of the best runners left, and as work was very pressing, the foreman of the floor was asked the reason of their leaving. He replied "You people don't pay wages enough, and don't pay in the right way to keep good help."

As orders that could not be filled were still coming in, and new boys neither stayed long nor got out much work, a meeting of the executive board was held, and the superintendent, his assistant and the foreman on the boys' floor were called in to give their views on the subject. A number of plans were discussed, and it appeared that the company was willing to pay more wages if it could be done without increasing the pay roll; lots of people are willing to do it that way.

The super thought that it would be well to try three boys on a machine again and pay each boy a little more than they were getting then; this would reduce the pay-roll anyway, and might help the other trouble. It was even proposed to try girls again. They always tried these experiments when they were crowded for work, and this last proposition made the foreman very tired. He had all the trouble he wished for just then, without trying an entire new set of hands. He having been mostly a listener up to this time, began to talk. "What you people need now," said he, "is more work from those machines. The very boys you have now can not only get out 500 gross per day, but they can do more than that, and will do it if there is an incentive for them to do so. You may think that if this is the case, that they can be driven to do it; but it's not so. Very few of the boys are actually obliged to work at their age, and their readiness to leave at any and all times proves this. They have a 'bread and butter independence' that is almost unknown to many men, and while they can be easily led, they won't drive at all. Now, as to wages, the runner ought to get more than the other boys. That will give the others something to try for and be an incentive for them to learn fast, so as to get the first chance to be a runner. When the boys first came back, they all, thinking that the runner was to get more, were asking me for a chance to run; but now I have to drive them at that job, and some of them leave rather than take it. Again, when a boy is given a machine to run, he should be promised the same pay as other runners when he does as much good work, and that promise should be faithfully kept. Now, if you will advance the pay of all the boys some, and the runners more than the others, I will get them together and tell them that you propose to give the machine hands that get out more work an increase of pay, but that the gang on a machine that does not do better will not get any advance, also that if a runner does not do well with his machine, that another boy will be given a chance to try it. If it is put to them in the right way, I know that we shall get the result wanted, and it's not going to cost you anything, unless we do get more work out."

After some hesitation this plan was adopted. Runners were to be given $3.75, others $3.25 per week. This was afterwards increased a little. The boys, being called, readily agreed to try and see what they could do. The product jumped on the first day from 6,700 to 7,500 gross, and mounted steadily up to over 8,000 gross per day. As your Mr. Halsey says of men, so with boys—"A plan that proposes to increase wages can hardly fail to succeed," and things moved along smoothly. But no one knows what another experiment may bring forth. FLORIN.

Workmen's Savings.

Editor American Machinist:

Mr. Tecumseh Swift's article under the above heading was very interesting to me, and I should like to be allowed a little space in your paper on the same subject. According to the State report referred to, home-owners are credited with making higher wages and saving more of it than renters. Now, I do not think we must conclude that those who own property are in any way superior to renters, and the only way that I can account for the former having the better showing is because the man who has bought a home and is only able to pay part of the purchase money down, feels bound to make all possible time that he can work to meet the requirements of his mortgage; while the man who rents feels free to take a day off and take his family for an outing, and consequently his yearly earnings show less accordingly.

If we take the case of two men, both earning the same wages—say, $15 per week—one buying a home and the other hiring, and go through the figures as I

have done, I cannot see why the renter should not make the better showing. Again, should reverses occur or work fall short, the man who rents should be in far better trim for leaving the town than the owner. There is still another phase to the matter—employers sometimes like to say that their employees own their homes; but I believe some would not hesitate to refuse to raise a man's wages simply because they know that he is tied; and should he leave, his home would depreciate in value at once. As to the struggling that Mr. Swift speaks of, I will venture to say that the sight of a piece of loose plaster has deprived more than one man and his family of many comforts—perhaps some book, technical or interesting, or some new tool or instrument, or some piece of furniture. So, then, as one who has passed through the mill, I would advise a young man not to buy a home on the installment plan, but to lay by any surplus of his earnings for future use, but not to the extent of having to do without that knowledge that will enable him to follow his calling intelligently.

Oneonta, N. Y. WM. NEWTON.

A Foreman's Time Notes.

Editor American Machinist:

There are many shops where it is quite important for the foreman to have a fairly accurate idea of the time taken on odd jobs, so that he may be able to say at short notice what time it will take to finish work as presented to him. For a number of years I had this experience, and to take the hours with as little delay as possible the system here shown was used. I had a small note-book, and inside the front cover I placed a list of letters used to designate the different kinds of work on a job, like this:

Lathe, L.	Boring mill, B.
Planer, P.	Vise, V.
Drill Press, D.	Floor, F.
Shaper, S.	Boy, +.
Slotter, Sl.	Laborer, H.

These were of course soon so familiar that I had no use for the list. A page of my note-book would then look like this:

April	TIME ON CONDENSER.								
2	L 6	F 10	D+ 10	D 5					
3	F 10								
4	D+ 10	F 10							
5	F 10	B 10	B 10	B 10	F 10	F 10	P 8	L 9	
6	D+ 10								
7	D+ 9								
9	D+ 10	L 10	L 10	+ 9	F 8	P 6	P 4	L 10	
10	L 6	L 7	L 10	L 8	D 10	V 10	P 10	P 6	L 4
11	L 5	F 3	V 10	L 9	L 9	L 7	L 10	L 8	P 6	F 3
12	L 4	F 8	D 10	D 6	D 8	D 10	P 10	Sl. 7		

In taking the time, I had the page of my note-book ruled, so that for each date I would enter the hours, and over this I would mark the letter that denoted the kind of work, whether lathe, planer, etc., and as to who did the work, a man or boy, and also whether a mechanic or a laborer. It has been a very easy matter to take down a thousand hours, and in this way the amount of work done by each kind of a tool would be noted, as well as the vise and floor. There were a great many disputes as to time decided by this record.

This matter of taking time on a job is very much the same as many other duties of a foreman. It tends to strengthen his faculties in the management of his department, and it will bring to his notice matters that might otherwise escape him. It is the constant watching that brings success to the watcher. There are hundreds of cases in which some error has been avoided by this methodical management and careful attention to small things. One of the most striking instances of this came to my notice a number of years ago in a manufacturing town in New England. We were putting in a very large plant of machinery, and there was with us a gang of plumbers who had a good deal of lead-melting to do, and they would put up a small brick furnace near the side of the building, start a fire and put on the pot of lead. This would of course blacken the bricks, so that they could not be used on the outside of a wall. and it so happened that they picked out some of the finest bricks, because they would lie squarely together. But they came suddenly to grief, on account of the owner of the plant noticing the blackened bricks. It happened that I was the first one he saw and asked who used those bricks for that purpose; and without waiting for my answer, he said, with great emphasis: "The man that blackened those bricks will never be rich. He has taken the best of the lot, when there were old bats that might have been used." That man was one of the most successful Governors of the State of Connecticut. His idea of looking after small things seemed to me something wonderful; and the fact that he wished to train those in his employ each to attend strictly to the duties of his position, not only in labor but in strict economy, showed his ability as a manager. H. S. BROWN.

Easton, Pa.

One Way to Pay Off.

Editor American Machinist:

In your issue of May 25 appeared an inquiry entitled "How to Pay Off," by Morris Fulton. As I have seen no reply to the same, I will offer one. I was once employed in a works employing over 5,000 men, and where we paid all hands every Friday night in about fifty minutes after the 6 o'clock whistle blew, by the following system:

First—Registration of new men was accomplished by their appearing before the paymaster, where each man's name, in full, was given, and what shop he was going to work in. Then a card was given him, which had a number and instructions for his guidance on pay day. In case of a man quitting, his number was not issued to another for at least three weeks after the man had quit.

Second—The foundry, on account of working piece work, and the men going home as soon as they had poured and shaken out their molds (which often let them out from one to two and a half hours before the regular quitting time), were paid at 12 o'clock noon in their superintendent's office.

Third—The system used was as follows: When the foreman of a department gave the signal to fall in, each man got in line according to his registry number, and then they marched single file to the paymaster's desk, with the foreman at the head of the line. When about 40 feet away from the paymaster's desk the foreman stepped to one side, and as each man came up he called out his number then walked up to the paymaster and called out his name, when his envelope was handed to him, which was done so quickly that it kept the men on the run from the separate departments. When a man was in the wrong place, he was taken out of the line and compelled to stand on one side till the department was paid off, when he was allowed to form a rear guard. If a man was not in line on pay-day, he would only be paid between the hours of 12 M. and 1 P. M. any day after, when he would have to sign for his pay.

The envelopes were put on boards which had tin uprights at each end, one board holding about 150. ALFRED SPEED.

Oswego, N. Y.

Fixing Up a Planer.

Editor American Machinist:

The work of our big planer showed chatter marks. Whether the cut was light or heavy they lately appeared so strongly in evidence of something wrong that it was decided to find out the cause and overcome it at any cost.

The said planer is one of the regular standard makes, and has seen about eight years of service. The ways, or shears, being somewhat abraded, it was first thought the trouble might be there, so both platen and shears were replaned and finished as usual, by scraping to a smooth, true bearing; result, no apparent benefit.

Now, it is not real fun to move a heavy platen along the shears by hand, and so as to avail himself of mechanical assistance, our machinist made a couple of turns around a nearby revolving shaft, with a rope, one end of which was fastened to the platen; by pulling on the free end sufficient frictional contact could be obtained to move the platen along the bed.

Unfortunately the rope came in contact with the hub of a pulley on the shaft, and if it hadn't broken something else would. Then to raise it he got a hoist fastened to the hanger beam, or stringer piece, but forgot to shore it up; result of this experiment, a job for the carpenter.

Then, one gear having a little more looseness than its fellows, it was considered the offender, and a new blank prepared. The beauties of involute and epicloidal teeth then became strikingly apparent, for after we had the gear cut it didn't match because it was cut with a different style of tooth cutter from the others. We might have found it out before, but we didn't.

Then outside authorities were appealed to, with widely varying results in the diagnosis; one party being sure we didn't properly tighten up the gibs and parts of the cross head; another was equally sure that we didn't know how to forge a tool, or if we did, that the grinding was rather worse than indifferent, not to mention the setting of the tool; a third thought the trouble might lie in the shafts having worn loose in their bearings; yet another could imagine the foundation was shaky.

The disagreement of our advisers, all of them practical men of wide experience—two of them responsible for the management of large mechanical interests—served to show that a multiplicity of causes might so affect the machine as to produce a chattered surface on the work. It is also feared that the net results of the aforesaid advice rather lowered our estimation of their individual judgment.

Carefully going over the foundation didn't seem to help perceptibly. Planing a strip of tallow—which offered practically no resistance to the tool—rather disproved the theory of any looseness being the cause of the trouble, or that the tool itself was at fault, for the same familiar chatters appeared as usual.

About that time some bright fellow discovered that the chatters possessed the characteristic of being regular, a certain definite number to the inch, and also that the number of chatters, for one revolution of the shaft next to the driving pullies, coresponded with the number of teeth in the gear on it. This seemed to clearly indicate that the gears caused the trouble, and a new set was wired for from the manufacturer. When they arrived and were put in position the chatter changed to a lesser one with a coarser pitch, which tallied with the number of teeth in a gear on the secondary shaft; a second set being obtained our trouble disappeared entirely.

Perhaps the next time we will know better where to look and what to do, as well as what not to do. PLANER.

Shop Literature.

The Publication Department of the C. W. Hunt Company sends us the following notice as being of possible interest to us, and we print it as a suggestion. We feel impelled to say, however, that, in our opinion, no mechanic who expects to follow the business and succeed in it should fail to take for himself, and to keep on file for future use, such a journal as ours. Every mail brings us evidence of the unwisdom of the other course, in the shape of letters from men who want us to hunt up, in back numbers of the paper, articles we have published on certain subjects and send the numbers. We are unable to do this, and we know of numerous cases in which inability to obtain certain articles has proven very embarrassing. The fact is that a man can seldom know what position he may find himself in in the future, and the wisest men endeavor to provide for contingencies, so far as possible. Those best able to judge of the matter declare that a file of the "American Machinist" is far and away the best reference library in existence for all matters pertaining to shops and the design and construction of machinery. In the drafting rooms of the best shops of the country it is constantly being used as a reference library, and it seems clear that he who fails to keep it for possible future needs is making a mistake. The notice referred to is as follows:

NOTICE TO EMPLOYEES.

"The Publication Department wishes to announce that employees of the C. W. Hunt Company, may borrow from its files the following publications: [Here follows a list of thirty-one publications.]

"Papers must be kept clean, and not cut or torn, and returned within three days. In case of loss or injury, prompt notification is requested, so that duplicate copies may be immediately obtained.

"We have, or will obtain more than one copy of such papers as the 'American Machinist,' for which there is considerable demand.

"C. W. HUNT COMPANY,
"Lillibridge, Publication Department."

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(67) C. W., Cincinnati, writes: I have to finish by lapping a good many small holes in steel varying from ½ to 1-16 inch in diameter. I use a copper lap and fine emery, but find that I cannot get the exact size all through the hole. The ends are larger than the middle, and I would like to know how the trouble may be avoided. A.—This trouble sometimes cannot be entirely avoided, though it is lessened by arranging to do as little lapping as possible. That is, to have the hole originally, by grinding, as near the finished size as may be. You will find, also, that a cast-iron lap is better than copper and will be likely to cause less enlargement at the ends. Sometimes, however, the difficulty cannot be otherwise overcome, and it is then the practice to leave a thin ring of the steel around the edge of the hole to be lapped at the same time and to be removed by the grinding afterwards, thus removing that part which has been unavoidably enlarged in the lapping operation.

(68) R. A. Z., Tarboro, N. C., asks for information regarding the proportioning of cooling surface in surface condensers to the size of the engine. A.—The following table gives modern marine practice:

Absolute Terminal pressure.	Square feet of surface per I.H.P.
30 lbs.	3.00
20 "	2.50
15 "	2.25
12½ "	2.00
10 "	1.80
8 "	1.60
6 "	1.50

The table is based on the use of sea water of an average temperature of 60 degrees. Another rule, based on a temperature of 75 degrees in the circulating water and a vacuum of 25 inches, is

$$S = \frac{17\ W}{180}$$

in which

S = condensing surface in square feet.
W = pounds of steam to be condensed per hour.

(69) W. S., Canada, asks how much increase of power would be obtained from a boiler by raising the steam pressure from, say, 70 pounds to 150 pounds. A.—The increased economy of high-pressure steam is due to the engine, and not to the boiler, and the increased power obtained from the same boiler by increasing the pressure can only be that due to a smaller consumption of steam per horse-power by the engine. There is no reason why a greater number of heat units should go through the heating surfaces because of an increase of pressure. On the contrary, there should be some loss because of the increased temperature of the water due to the increased pressure. In other words, calling a boiler horse-power the equivalent of the evaporation of a definite amount of water from and at 212 degrees, the increase of pressure should lead to a slight loss. If, however, this steam were used in an engine properly designed for it, the reduced consumption of steam per horse-power by the engine would much more than neutralize this loss and give a net gain for the combination of engine and boiler. Boilers do not develop power at all. They simply make steam, and with the steam an engine may develop power.

(70) E. W. H., Rochester, N. Y., says: A bar of steel is ⅞ inch in diameter and 6 inches long. If it breaks under a load of 45,000 pounds what is the actual strain per square inch on the outmost fibers? A.—It is impossible to say. The formula for the strength of beams gives the strain on

the outer fiber from the applied load, but it is true up to the elastic limit only. This because of the fundamental assumption of the formula that the stretch of the various fibers is proportional to the stresses carried by them. This assumption is true if the fibers are not strained beyond the elastic limit, but it is not true beyond that point. In other words, if a beam is loaded within the elastic limit the formula will give the true stress on the outer fibers, but if loaded beyond that point it will not give the true stress. Conversely, the load which the beam will carry with a given fiber stress up to the elastic limit can be calculated by inserting the fiber stress in the formula, but the load which it will carry at rupture cannot be calculated from the tensile strength, nor can the tensile strength be calculated from the breaking load. In point of fact, beams carry heavier loads before breaking than those obtained by calculation from the tensile strength of the material, and conversely the apparent tensile strengths obtained by calculation from the breaking loads exceed the true strengths. Constants obtained in this way are called moduli of rupture, but they are of very little practical value. The values of the moduli vary with the cross-section as well as with the material. With I-beams, in which the material is concentrated in the flanges, the value of the modulus would approach most nearly to the tensile strength, while with the opposite distribution the discrepancy would be greater. A round beam is obviously nearly an extreme case of the opposite kind, and the discrepancy with such a beam would be large. We say this without any knowledge of comparative experiments on round and square beams, but give it as the natural conclusion from the known properties of materials.

The Growing Use of Steam and Other Motive Power in Germany.

Consul Monaghan reports that the use of steam and other motors is rapidly increasing in Germany. "From 1875 to the present time," he says, "the number of concerns using motor power has increased sevenfold, the horse-power threefold or fourfold. According to the census of 1895, 3,421,194 horse-power was employed. Of this power, 2,715,078 was put down to steam, 629,065 to water. The 3,421,194 horse-power represents only the real power put forth, not the indicated or possible power. It seldom happens that an engine or motor is used at anything like its indicated capacity. The power used in agricultural pursuits, railroad, river, harbor and coast transportation, etc., also the great central stations that supply power to other concerns, is not taken into account in the foregoing. The German railroads employed in 1895 16,377 locomotives (16,107 on the wide-gage roads and 270 on the narrow-gage). Giving the wide-gage-road engines an average of 450 horse-power, and the narrow-gage 150, we get for the Empire's locomotives 7,288,000 horse-power. Among the farmers of Germany (in 1894-95) 259,364 farms used steam threshers, 1,696 steam plows, and 26,000 milk centrifugals with power. Ocean steamers (1,061) had, in 1895, 801,750 horse-power; river, harbor and coast steamers (1,530) had 171,360 horse-power. These figures are all for 1895, and there has been a constant increase since. I am not sure that there is not a field here for our better class, high-grade engines. The tendency everywhere is toward steam, water, electrical and gas powers. Engines, if cheap enough and good enough, ought to go as well here as with us. The demand is not decreasing. Agricultural machines, most of which had their origin in our country, are imitated; how successfully, only one familiar with the machines can say. If we work half as hard as do Germans, we can conquer markets in Russia, the East, South Africa, Australia, etc., where our machines are almost sure to succeed, price for price, against all others."

Technical Publications.

"Chimney Design and Theory." By W. W. Christie. 104 6x9-inch pages, with 40 illustrations. D. Van Nostrand Company. Price, $3.

A good book on chimneys is needed, and this one will go far to supply the want. It discusses its subject from all standpoints—size, construction, stability, foundations, etc., giving separate chapters to brick and metal chimneys, and devoting a good deal of space to illustrations and descriptions of existing chimneys, both brick and steel. In some respects the book is not altogether happy. Its arrangement is somewhat heterogeneous, and the author is not always clear. Thus on page 11 we find a statement that the hight of the water column draft gage is "directly proportional to the hight of the chimney," while on page 139 we are told that "the draft of a chimney varies as the square root of the hight," both of which statements are true if correctly understood, but are scarcely clear as they stand. The engravings and descriptions of existing chimneys form the most useful portions of the book. Some of these descriptions are very full and complete, while others give a meagre outline only, and there is a general deficiency of statement regarding the duty for which they were designed. To sum up, the book will be found decidedly useful to anyone having chimneys to design or construct, though it can hardly be said to be all that is to be desired as a treatise on the subject.

"Record of Recent Construction, No. 13," by the Baldwin Locomotive Works, of Philadelphia, consists wholly of plates of curves drawn upon squared paper and designed to facilitate the simpler and the most often required calculations pertaining to locomotive design. These are accompanied by the necessary explanatory text, and the series will be found very useful to those who have to do with locomotives. The pamphlet is bound in flexible canvas, and is standard, 6x9 inches, although most of the plates are larger and are folded in. We understand a copy will be sent free to any address on application.

Personal.

Our contributor, J. L. Lucas, formerly of Providence, is now foreman of the die and tool room of the Bridgeport (Conn.) Brass Company.

The firm of Garrels & Freeman, consulting engineers, of St. Louis, Mo., was dissolved by mutual consent July 11. Mr. Garrels succeeds to the business and good will of the firm.

Mr. Ralph G. Hannon, former treasurer and general manager of the American Steam Gage Company, of Boston, Mass., has severed his connection with that company to form a connection with The Utica Steam Gage Company, of Frankfort, N. Y., and has been elected secretary of that company.

Mr. E. D. Woods, inventor of the grinding machines illustrated in our issue of February 9, the product of whose factory is handled by the Niles Tool Works Company, has become connected with that concern, where he will superintend the manufacture and sale of his specialties in grinding and polishing machinery.

Mr. William J. Smith, of the Geometric Drill Company, Westville, Conn., sailed on the 15th inst. for Europe, where he will spend two or three months looking after the growing foreign business of his company. He expects to visit Great Britain, Germany, Holland, Belgium, Norway, Sweden, Denmark, France, and possibly Russia.

Obituary.

Joseph Stokes, superintendent of the New Jersey Steel & Iron Works, Trenton, N. J., died there July 2; sixty-six years old. He was a native of England and came to this country as a lad. He was a roller at the Trenton Iron Company's mills, and became assistant superintendent and finally superintendent.

John C. Matthai died at his home near Baltimore July 4; seventy-eight years old. He was a native of Germany, where he learned blacksmithing and edge tool making. In 1846 he established himself in Baltimore as a blacksmith, and in 1870 the firm of Matthai, Ingram & Co. was founded for the manufacture of tinware.

S. H. Holley, manager of the Lake Shore Iron Works, Marquette, Mich., died

(*Continued on page 41.*)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later that Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant ; see p. 16.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer. Mach. T. Co., Meriden, Ct.

Punches & dies. Wal. M. Wks., Waltham, Mass.

Light and fine mach'y to order ; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," price $1, post paid. J. L. Lucas, Prov., R. I. Send for index sheet.

15-ton electric crane, 40-foot span. MacGregor-Gourlay Co., Ltd., Galt, Ont., Canada.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Wanted—A second-hand power shear for cutting heavy scrap brass. Address McNab & Harlin Mfg. Co., Paterson, N. J.

For Sale—Four 10-ton jib cranes, in good order, with jib 27 feet long, for sale cheap. Address Dawes & Myler, New Brighton, Pa.

Bound volumes of "American Machinist" for 1893 and 1894, cloth, good condition, $3 each ; one of 1888, morocco, $4. "Volumes," care AMERICAN MACHINIST.

Threads and gears ; easy rules to cut any thread possible to be cut in the lathe, without algebra, sent to any address for 25c. by G. W. Dixon, Spring Lake, Mich.

Gear and milling cutters, adjustable reamers and special tools ; vertical millers, cutter and surface grinder and shears. Catalog of small tools free. R. M. Clough, Tolland, Conn.

The Henry Vogt Machine Co., Louisville, Ky., in the market for 30-ft., 15-ton electric crane, 24-inch foundry molding machine, and 24 or 30-inch turret lathe ; send description and price to them.

Institutions retiring from business having machine tools, brass or wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Partner Wanted—An all-round machinist, to take half interest in old-established machine shops ; valuable plant ; strictly cash business done ; $5,000 needed ; proprietor, ill-health, retiring ; excellent opportunity to right man ; full particulars. Address "Canadian," AMERICAN MACHINIST.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded ; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Situation as foundry foreman, by an experienced foundryman ; best reference. Box 116, AMERICAN MACHINIST.

Position as brass foundry foreman, by an up-to-date hustler ; 20 years' experience, 8 as foreman. Address Box 122, AMERICAN MACHINIST.

American of some experience on the road, practical machinist, hard worker, good habits, wants position as traveling salesman. Box 113, AMERICAN MACHINIST.

Wanted—Position as assistant superintendent or assistant foreman ; first-class machinist ; in charge of department at present. Box 124, AMERICAN MACHINIST.

Wanted—A position as assistant layer-out, boiler maker or sheet-iron worker, by a steady, sober man ; repair shop preferred. "Reliable," AMERICAN MACHINIST.

Young man, familiar with the manufacture of electrical machinery ; competent to fill position of foreman or superintendent ; references. Box 117, AMERICAN MACHINIST.

Experienced foundry foreman on loam, green sand and dry, wants position ; engine or special work ; N. E. or N. Y. shop preferred. Box 125, AMERICAN MACHINIST.

A graduate (M. E., 1899) of Sibley College, Cornell University, wishes employment ; gas and gasoline eng. work preferred ; refs. Address Box 118, AMERICAN MACHINIST.

Machinist, tool-maker, 33 years old, American, technical and business education ; position desired where ability is recognized ; can handle men ; modern methods. Box 114, AMERICAN MACHINIST.

Experienced designer for automatic machinery and electrical apparatus, 8 years' shop and 7 years' drawing-room experience, wants to change. Address Box 123, AMERICAN MACHINIST.

Assistant superintendent desires a change ; technical graduate ; 5 years in drafting room and shop ; familiar with the premium plan and can introduce the same ; best references ; ordnance work preferred. Box 121, AMERICAN MACHINIST.

Position as superintendent or foreman of tool or machine works ; 15 years' practical knowledge, from designer to foundry ; A1 on molding, machine patterns ; licensed engineer ; best references ; now handling 100 men. Address "Yankie," AMERICAN MACHINIST.

Mechanical engineer wishes to make a change ; has had five years in the shops, three as works manager and seven as designer of high-class machine tools, hand and power traveling cranes and special machines ; possesses executive ability. Box 103, AMERICAN MACHINIST.

Position as superintendent or assistant, by mechanical engineer, 33 ; college education, shop experience, business training ; pumping, marine, hoisting and general machinery ; in charge of men in present position ; executive ability ; highest references. Box 119, AMERICAN MACHINIST.

A practical mechanic with 11 years' experience in shop and drawing room and 5 years in business office, believes he could be of value as superintendent or assistant manager of a good machine business ; can handle advertising, systematize office and handle men. Box 92, AMERICAN MACHINIST.

Situation as foreman or superintendent, by a practical middle-aged man ; up on modern methods and able to get out work at lowest possible cost ; have experience on general machinery, sewing machines, fine tools and instruments, etc. ; will be open for engagement in August. Address Box 109, AMER. MACH.

Situation with manufacturing concern sought by efficient man ; high character ; good address ; educated ; mechanical training ; long business experience in office and traveling ; accurate and disciplined. Any reasonable position with moderate salary, offering chance of promotion. Refers to
John J. Grant, Cleveland, Ohio.
Hoopes & Townsend Co., Philadelphia, Pa.
Julius Uihlein & Co., Cincinnati, Ohio.
Gleason Tool Co., Rochester, N. Y.
Charles S. Strelinger, Detroit, Mich.
W. W. Collier, treas., American Harrow Co., Detroit.
Whitman & Barnes Mfg. Co., Akron, Ohio.
Box 120, AMERICAN MACHINIST.

Help Wanted.

Pattern-makers wanted at once. Apply at The De La Vergne Ref. Mach. Co., foot E. 138th st., New York.

Wanted—Good, all-round machinists ; state age, experience and wages wanted. Beall Machine Works, Cumberland, Md.

Wanted—First-class tool men and general machinists ; state age, experience and wages expected. Box K, Coxsackie, N. Y.

Wanted—Several first-class pattern-makers ; $3 per day for 10 hours, 55 hours per week ; steady work for good men. Sprague Elec. Co., Bloomfield, N. J.

Working foreman for machine shop in Connecticut city ; 20 men now, and growing ; state experience fully and pay wanted. Box 108, AMERICAN MACHINIST.

Wanted—Salesmen to sell tapping attachment and sensitive drill on com. ; are good sellers and will make profitable side line. Union Tire Co., Plainfield, N. J.

Wanted—A teacher of metal work in a technical school. Apply by letter, stating age and qualifications in full. Instruction Committee, 36 Stuyvesant st., New York.

Wanted—Foreman for machine department of large structural iron works, engaged in the manufacture of bridges, buildings and similar works. Address "Rotary," AMERICAN MACHINIST.

Wanted—First-class machinists and toolmakers, including assistant foreman on small fixtures and fine die work. Address, stating complete experience, age, wages expected and references, Veeder Mfg. Co., Hartford, Conn.

Wanted—A few good, reliable mechanical

(*Continued from page 40.*)

July 4 ; fifty years old. He was a native of Wisconsin, and at seventeen he began to learn the machinist trade at Houghton, Mich., becoming foreman of the shop at an early age. He was later an engineer on the lakes and in the machinery business in the Black Hills. In 1887 he went to Australia, soon returning and locating at Marquette. He invented the Superior gas engine, an amphibious boat and other devices.

draftsmen ; those familiar with rolling-mill work preferred ; only first-class men need make application. Address Chief Draftsman, care Illinois Steel Co., South Chicago, Ill., Station "S."

We are enlarging our works, and will shortly require an increased number of skilled mechanics ; we invite applications from draftsmen, pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—An intelligent, technically educated machinist of independent judgment, thoroughly experienced in the construction and assembling of fine automatic machinery, to act as an inspector ; state age, line of machinery heretofore associated with and how long, and give references, which must be first class ; liberal salary paid to the right man. Address Lock Box 707, Washington, D. C.

In one of the seaports of the Middle Atlantic States, by machine works, a competent man to take charge of experiment room ; party must be a first-class machinist, thoroughly understand drawings, and have some natural ingenuity which will enable him to experiment, if necessary, on his own account and arrive at conclusions. Address Box 112, AMERICAN MACHINIST, stating former positions and experience, also salary.

HELP WANTED.

Seven Lathe hands, five Vise hands, two Planer hands, and two Drill Press hands for new shop equipment. Good wages. Finest shop in the country, located in beautiful suburb. Living expenses very low.

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of the Cross Oil Filter will demonstrate that it reduces oil bills 50 per cent. or more. If it doesn't you may send it back at our expense. The trial is free.

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Drills for Light Work.
We make drills from one to eight spindles, hand and automatic feed. Send for price of the
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Double Head Traverse Drills ; also adjustable Two Spindle Drills, Tapping Machines, Cutter Grinders, Surface Grinders, Centering Machines.
Write for Catalog.
Woodward & Rogers, Hartford, Conn., U. S. A.
European Agents: { Selig, Sonnenthal & Co., London, Eng. / E. Sonnenthal, Jr., Berlin, Germany.

The city of Philadelphia is having much trouble with its water works system, the water being in fact not fit for drinking until it has been boiled and filtered. The "Bulletin," of Philadelphia, in a recent issue contains an interview with Mr. W. Barnet Le Van, in which he proposes the plan of using the present system for fire purposes, for steam boilers, for flushing sewers, sprinkling streets, etc., and the construction of an entire new system for a supply of potable water. A supply adequate for the purpose can, he says, be readily obtained, and he considers it more advantageous to obtain a separate supply of pure water sufficient for this purpose than to attempt to change the entire supply of the system, which would be necessary if the present pumping system and distributing mains and pipes are to be used.

The power plant for the new electric equipment of the Manhattan elevated railroads of New York is to be capable of developing 100,000 horse-power. It will be located on the East River, between Seventy-fourth and Seventy-fifth streets. A contract has been awarded the E. P. Allis Company, of Milwaukee, for eight engines of a minimum capacity of 8,000 horse-power each, and capable of developing in the aggregate 100,000 horse-power. The bid of the Allis company was considered the most advantageous of the seven that were presented.

A press item announces that 800 men have been discharged from the Springfield (Mass.) armory owing to lack of work to keep them employed, the number retained being about 1,200. It is said that among the number discharged are many who are good men, and under present conditions they will certainly have little or no trouble in securing employment, for at present there is a very lively demand for competent men who can do any kind of work pertaining to machine construction.

Manufacturers.

The Diamond State Steel Company will erect new buildings at Wilmington, Del.

The Chicago Coated Board Company will erect a paper mill at North Water and North Pier streets, Chicago.

A contract has been let for the construction of two large additions to the cycle works at Mansfield, Ohio.

A new factory building is being put up by the Rochester (N. Y.) Land Company, to be occupied by the E. P. Reed Shoe Company.

The Utica Steam Gauge Company removed their general offices and shops to Frankfort, N. Y., recently to provide for their growing business.

Building permits have been issued to Erdmann Schultz for the building of a factory at Twelfth and Park streets, Milwaukee, Wis., at a cost of $10,000.

The Reed Manufacturing Company, of Erie, Pa., are building a new factory on the

(*Continued on page* 43.)

WANTED---SPECIAL MECHANIC.

An examination of applicants will be held at the Navy Yard, New York, July 25, 1899, for Special Mechanic at $4.00 per diem, skilled in laying out work and cutting patterns for galvanized iron workers in the manufacture of ventilating ducts, round and rectangular, straight and curved, with branches of varying sizes; also skilled in the manufacture of skylight work and in the use of modern machinery for sheet iron work. The examination will be open to all comers who can give evidence of experience in conducting the kind of work for which they seek employment, and who are citizens of the United States. Applications will be addressed to the COMMANDANT, NAVY YARD, NEW YORK, and must be delivered to him on or before Monday, July 24. No application received after that date will be considered. Each applicant will state in his application his name, age, residence, citizenship, present occupation (stating shop and position therein), and previous employment or work done. The application must be accompanied by evidence of citizenship, and by certificates, preferably from previous employers, as to character, habits of industry and sobriety, and skill and experience in conducting work of the kind required.

JOHN D. LONG, Secretary of the Navy.

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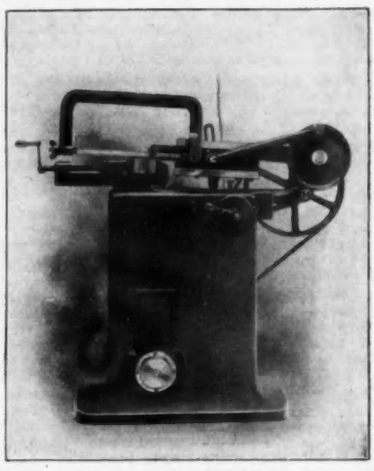

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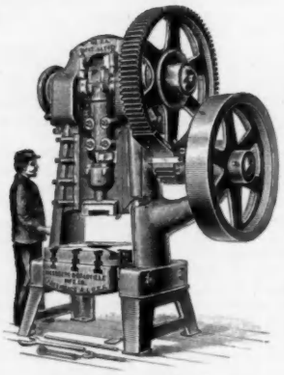

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